Interim Session — Seattle, Washington
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VOLUME XXX NUMBER 2

DISEASES

of the

CHEST

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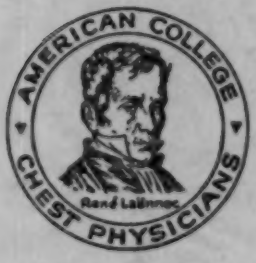

PUBLISHED MONTHLY

AUGUST
1956

PUBLICATION OFFICE, CHICAGO, ILLINOIS
EXECUTIVE OFFICE, 112 EAST CHESTNUT STREET, CHICAGO 11, ILLINOIS

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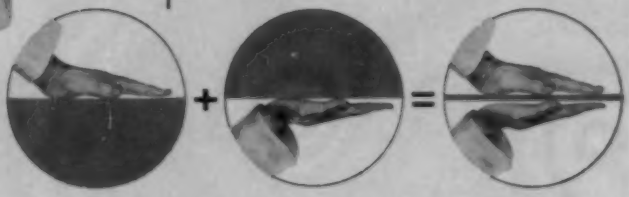

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1. Arnoff, B.: Personal communication. 2. Lazarte, J. A., and Petersen, M. C.: Personal communication.

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The Use of the Systemic Hemostat Carbazochrome Salicylate

J. C. Bacala, M.D.

(Abstracted from the Western Journal of Surgery, Obstetrics, and Gynecology, 64:88 (1956)

The author emphasizes the need for dependable chemical control of bleeding and oozing, and reviews the methods that have been tried to attain hemostasis, including the use of vitamin K and bioflavonoids.

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Many of the observations in this study, however, involved bleeding incident to trauma of incision, retraction, dissection, tearing and stretching. In these conditions, he reasons that Adrenosem causes hemostasis by its effect on the capillary intercellular cement substance so that the cells draw closer together, and the ends of the capillaries constrict, causing a "self-clamping" mechanism.

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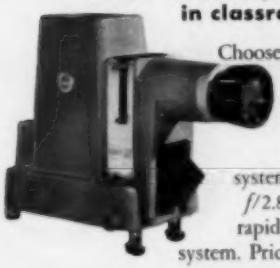

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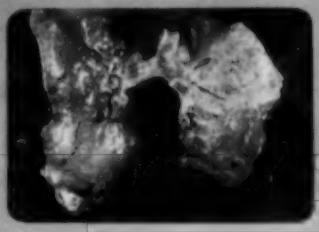

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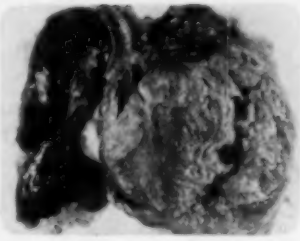

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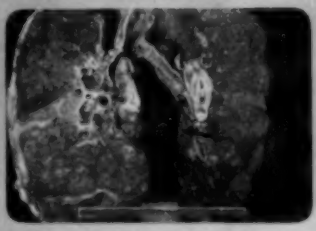

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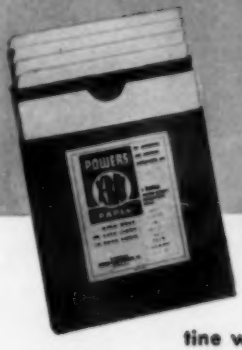

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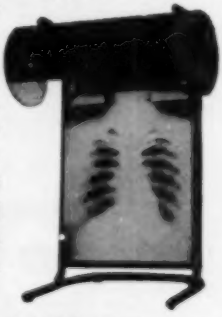

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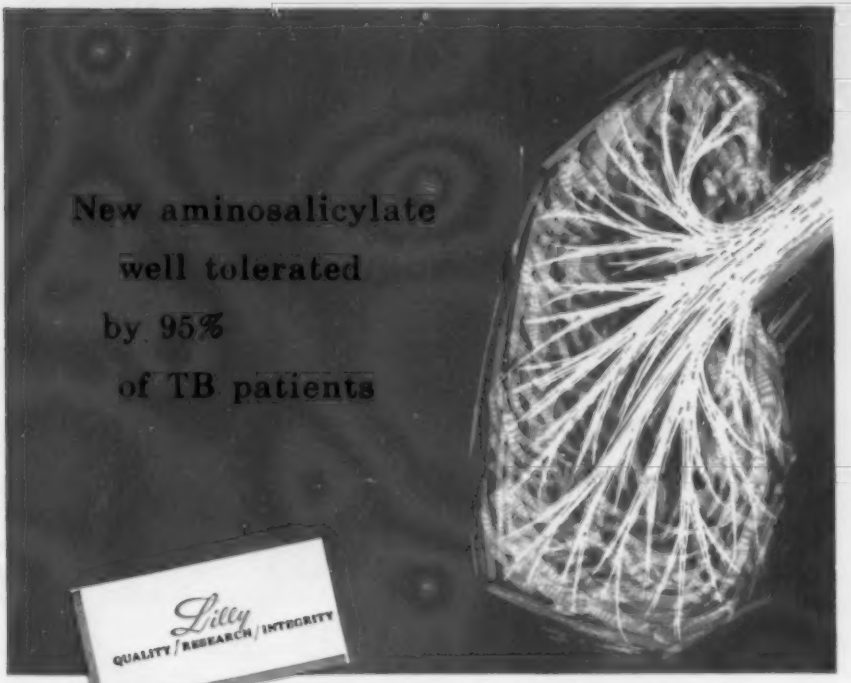

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References:

1. Winsor, T.: Am. J. M. Sc. *230*:133 (Aug.) 1955. 2. Grimson, K. S.: J.A.M.A. *158*:359 (June 4) 1955. 3. Grimson, K. S., Tarazi, A. K., and Fraser, J. W., Jr.: Circulation *11*:733 (May) 1955. 4. Grimson, K. S., Tarazi, A. K., and Fraser, J. W., Jr.: Angiology *6*:507 (Dec.) 1955. 5. Strawn, J. R., and Moyer, J. H.: Personal communication, 1955. 6. Maxwell, R. D. H., and Howie, T. J. G.: Brit. M. J. *2*:1189 (Nov. 12) 1955.

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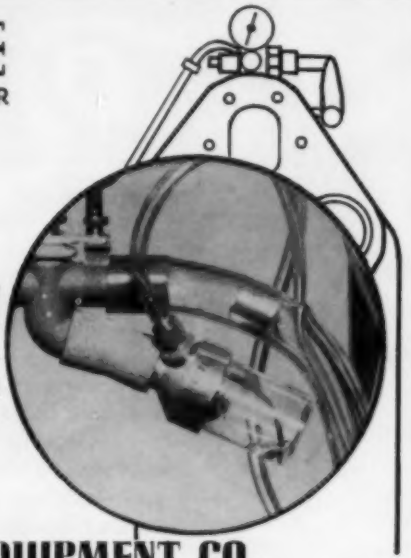

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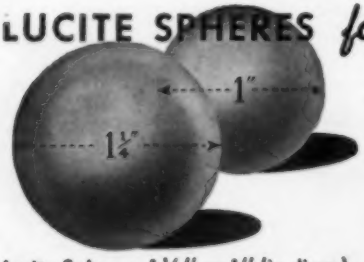

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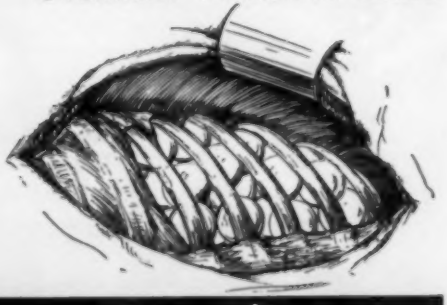

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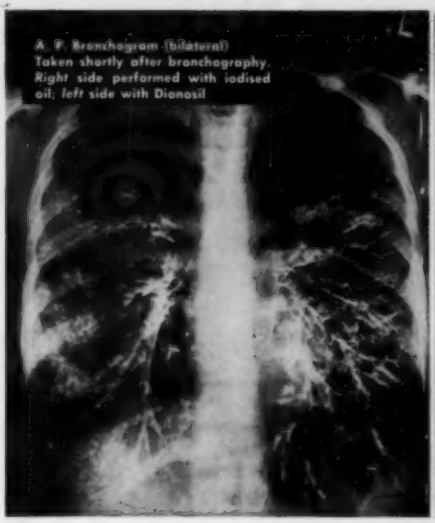

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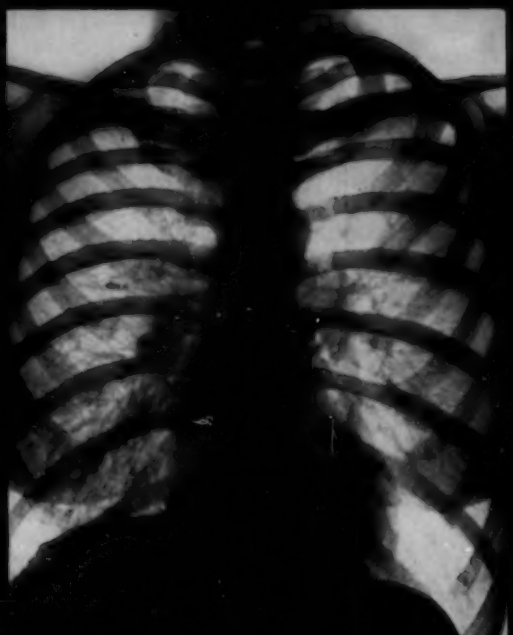

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1. Burrascano, J. J.: Sea View Hosp. Bull. *15*:149 (July) 1955.

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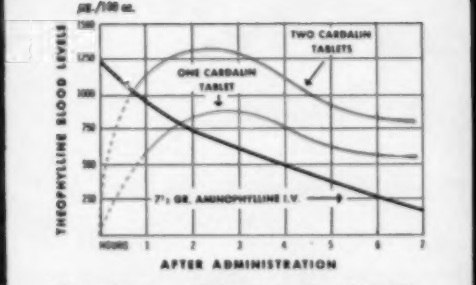
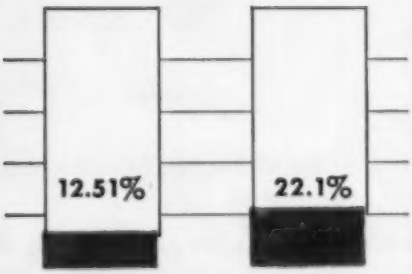


(Adapted from Bickerman, H. A., et al.: Ann. Allergy 11: 301, 1953, and Truitt, E. B., Jr., et al.: J. Pharmacol. & Exper. Therap. 100: 309, 1950.)



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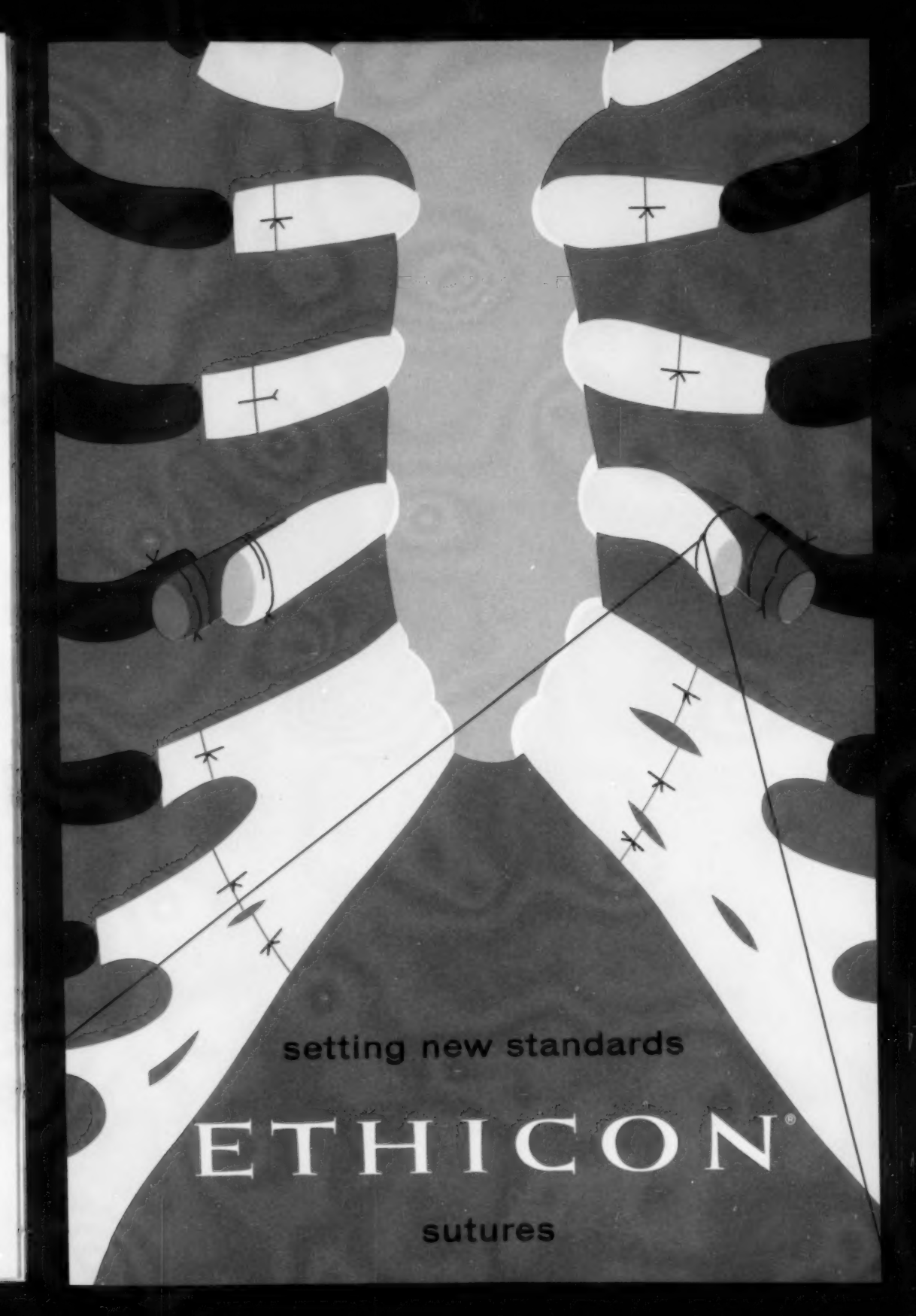
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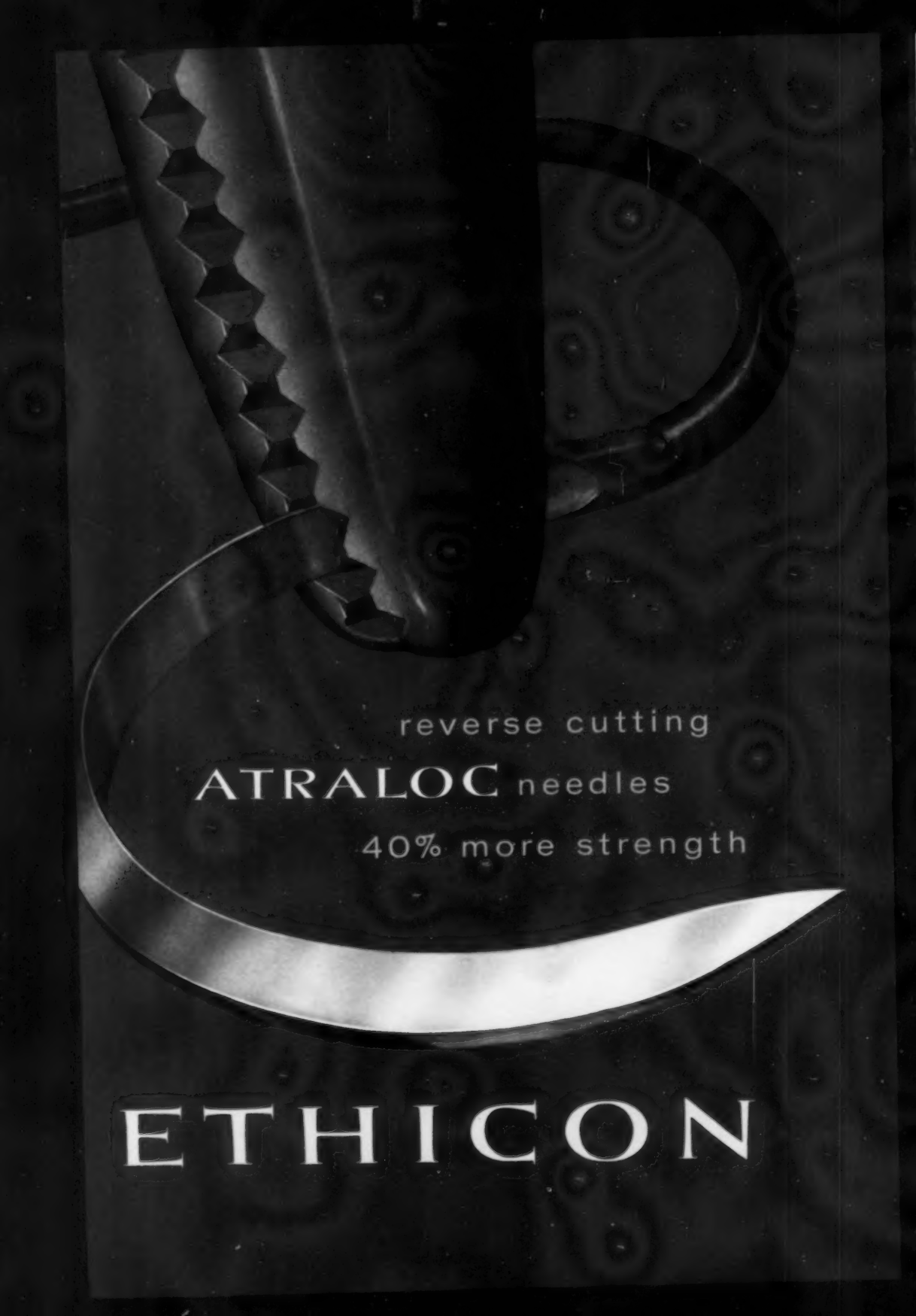
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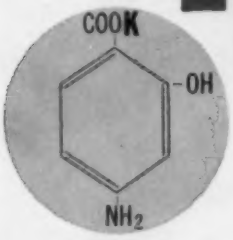

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1. *Molthan, L., Cohen, R. V., and Zarafonetis, C. J. D.: Clinical use of potassium para-aminosalicylate (KPAS). Am. Rev. of Tuberc. and Pulmon. Dis. 71:220 (Feb.) 1955.*

2. *Cohen, R. V., Molthan, L., and Zarafonetis, C. J. D.: Clinical Studies of Various Forms of PAS (with special reference to plasma concentrations). Read before the American Trudeau Society, Annual Meeting, Milwaukee, Wisconsin, May 23-27, 1955.*

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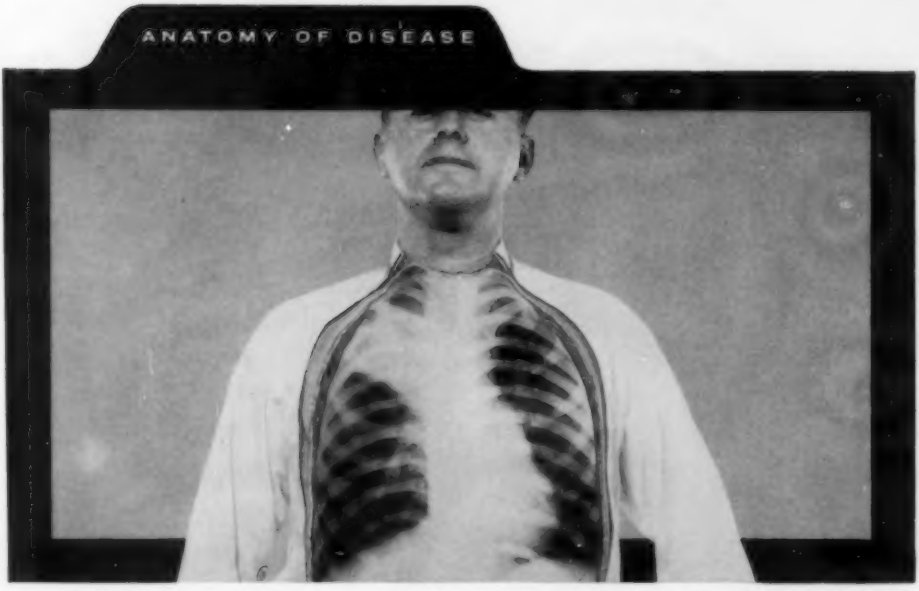

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1. Camarata, S. J.; Jacobs, H. J., and Affeldt, J. E.: Read Before The Southern California Chapter of The American College of Surgeons, Palm Springs, Calif., January 23, 1953.
2. Miller, W. F.: New England J. Med. 251: 580, 1955.
3. Limber, C. R.; Reiser, H. G.; Roettig, L. C., and Curtis, G. M.: J.A.M.A. 149: 810, 1952.

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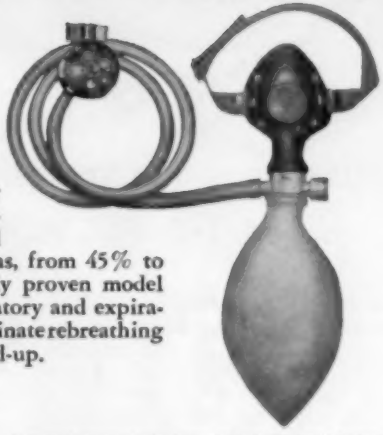

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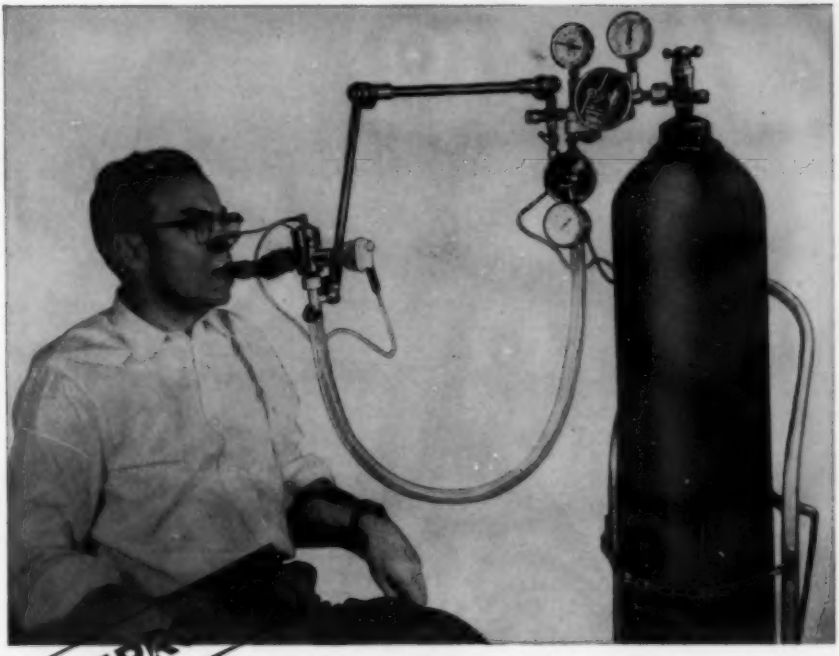

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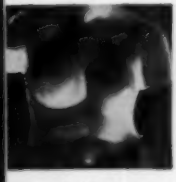

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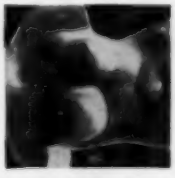

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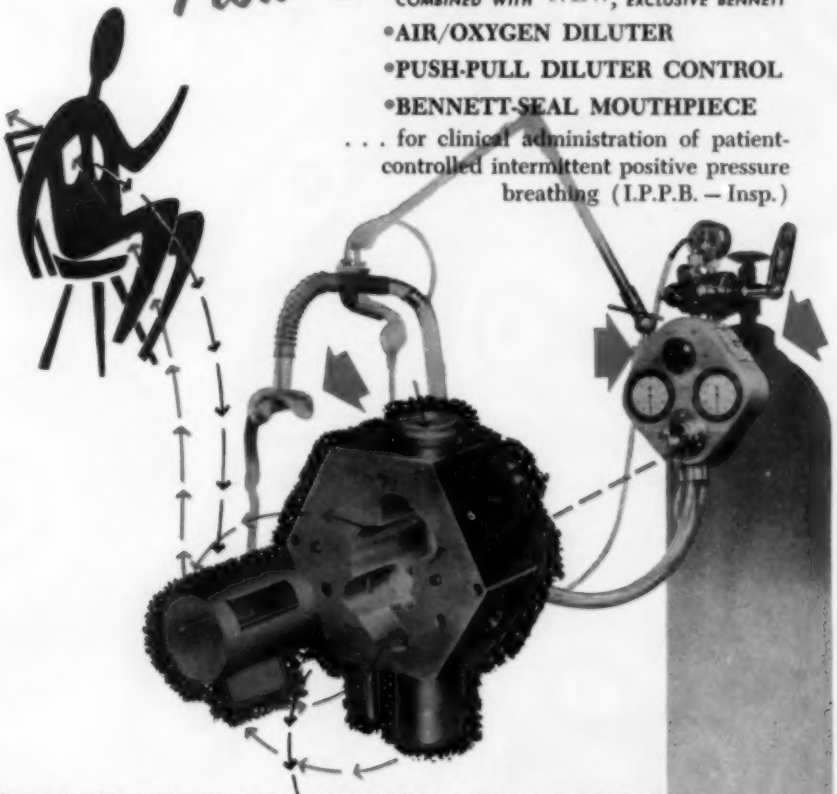

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DISEASES of the CHEST

VOLUME XXX AUGUST, 1956 NUMBER 2

The Direct Vision Correction of Calcific Aortic Stenosis by Means of a Pump-Oxygenator and Retrograde Coronary Sinus Perfusion

C. WALTON LILLEHEI, M.D., F.C.C.P., RICHARD A. DEWALL, M.D.,* VINCENT L. GOTT, M.D.** and RICHARD L. VARCO, M.D., F.C.C.P.

Minneapolis, Minnesota

Direct vision for intracardiac surgical procedures improves the quality of surgery performed, and for this reason it is likely that the blind or closed techniques will gradually be abandoned for all intracardiac lesions.

This transition has been accelerated by the development of an expendable and efficient oxygenator[1, 2, 3] which is used in conjunction with an equally simple pump[4, 5] to permit total cardiopulmonary by-pass in patients of any size (Figure 1). The reader is referred to these publications for details concerning the pump-oxygenator.

The remaining twin obstacles to a feasible method for open surgery upon the aortic valve in an unhurried manner have been the necessity of maintaining some coronary blood flow to the myocardium and the prevention of coronary air embolism.

Two possible solutions to these problems have been investigated in our experimental laboratories. For one approach we have perfused the coronary arteries via the direct cannulation of their aortic orifices with appropriately sized polyethylene tubes during the interval that the aortic valve was exposed. This method, although feasible, was found to have several undesirable features: It was technically somewhat difficult, the intima of the coronary arteries could be damaged by the cannulations, the presence of the polyethylene tubes interfered with widest exposure to the aortic valve, and finally there was an interval after opening the root of the aorta and before insertion of the cannulae during which the myocardium was without blood flow and when coronary artery air embolism could occur.

It may be suggested that direct vision reparative procedures be carried out upon the aortic valve rapidly enough to allow completion of the operation during a brief interval without coronary blood flow. While this is certainly possible, we have rejected this approach *a priori* for two physio-

From the Department of Surgery and Variety Club Hospital, University of Minnesota Medical School, Minneapolis.

*Research Fellow, American Heart Association.

**National Heart Trainee, USPHS.

Supported by Research Grants from: (1) Graduate School, University of Minnesota, (2) Life Insurance Medical Research Foundation, (3) American Heart Association, (4) Minnesota Heart Association and (5) National Heart Institute (H-830), USPHS.

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logic reasons. First, a time limitation is imposed which is undesirable for the patient. Secondly, however short the procedure can be made, the myocardium at the end of such an interval is left in an anoxic state. This is also true when selective cardiac arrest is induced without coronary circu-

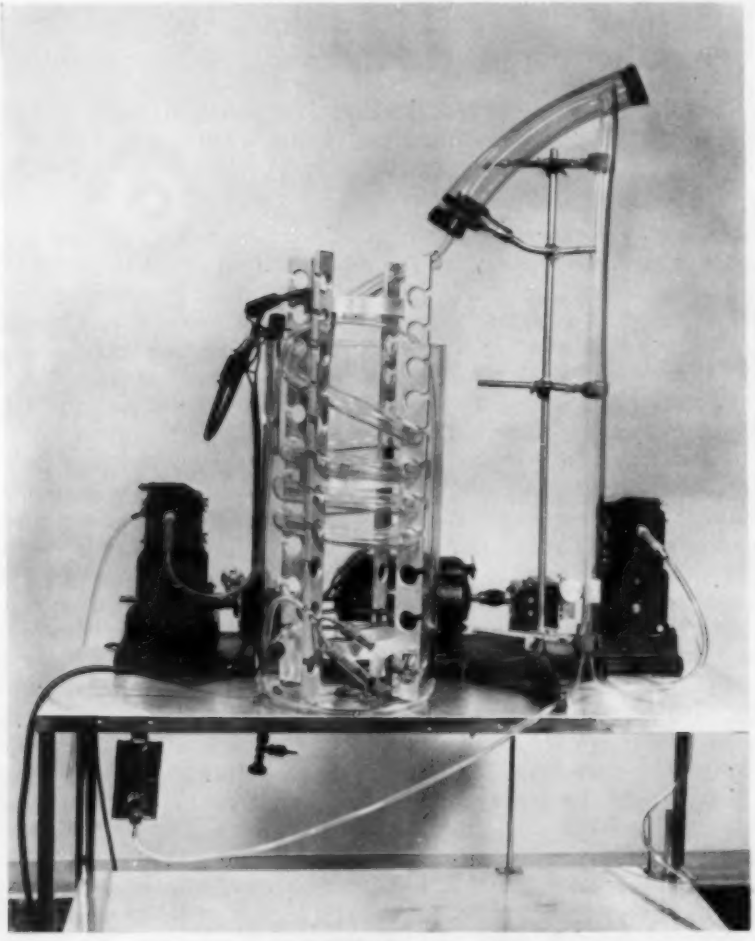

FIGURE 1: The Pump-Oxygenator Utilized for this Direct Vision Aortic Valvotomy. The pump consists of a single explosion-proof electric motor which activates two pump-heads (arterial, venous) each equipped with an individual speed changer all mounted on a single base. The artificial (large bubble) oxygenator has no moving parts, is sterilized by autoclaving, and is constructed entirely of polyvinyl plastic tubing which is discarded after each perfusion. From right to left may be noted: the vertical mixing tube, the transverse debubbling chamber, and the helix reservoir immersed in a constant temperature water bath. From the lower end of the helix the oxygenated blood is returned through disposable filters to the patient's arterial system. The oxygen gas enters the venous blood directly through a nylon diffusion plate at the base of the mixing tube. The venous blood carbon dioxide escapes with the excess oxygen during oxygenation.

lation. In critically ill patients this metabolic debt in the myocardium could be intolerable and vitiate an otherwise successful surgical procedure. The same considerations in a large measure pertain to the use of hypothermia and temporary arrest of the circulation for exposure of the aortic valve.

Pratt[6] in 1898 discovered that the excised cat heart could be temporarily nourished by way of its coronary venous system.

Roberts et al[7] suggested that this method might be of value in revascularizing the ischemic myocardium. Blanco, Adam, Fernandez, and Raffucci[8] have reported on experiments applying these observations to direct aortic valve surgery.

We have applied this principle to overcome the above mentioned obstacles to direct vision work on the exposed aortic valve.

The patient herein reported, the 116th to undergo total cardiopulmonary by-pass at the University Hospitals with maintenance of the circulation by an extracorporeal perfusion system, was the first individual we have operated upon with aortic stenosis. The pump utilized to replace temporarily the heart in this instance is depicted in Figure 1 and is the same instrument as previously described.[4, 5] Oxygenation was by the simple disposable oxygenator[1-3] (Figure 1). The patient's body temperature was maintained at a normal level throughout the operative procedure.

Report of Case

Case Report: M. J., the mother of two children, was 37 years of age at the time of her admission to the University Heart Hospital on January 9, 1956. She was diagnosed as having calcific aortic stenosis, functional Class IV (New York Heart Classification). There had been no definite history of rheumatic fever in the past, but she had had frequent episodes of pharyngitis and tonsillitis requiring hospitalization as a child. A heart murmur had been noted for the first time at the age of 24 years during her first pregnancy which otherwise was uneventful. At the age of 26 years with a second pregnancy and during delivery she experienced an acute episode of pulmonary edema, and was advised to avoid further pregnancies.

By age 28 dyspnea and easy fatigability had become prominent and she was considered a functional Class II cardiac.

When 31 years old she experienced episodes of paroxysmal tachycardia lasting up to 30 minutes. She received quinidine therapy at that time. Two years later she began to have episodes of vertigo, syncope, and paroxysmal nocturnal dyspnea. Frank congestive failure likewise appeared and she was digitalized. In the months immediately prior to admission she underwent rapid progressive deterioration. Despite digitalization, low sodium diet, and weekly injections of mercurial diuretics peripheral edema and orthopnea persisted. Severe dyspnea and angina upon even very slight exertion now resulted in her complete incapacitation.

Physical examination upon admission disclosed a chronically ill appearing woman who was dyspneic and orthopneic at rest. There was a harsh grade IV systolic murmur and thrill maximal over the midsternum at the level of the second interspace with transmission upward into the neck vessels. Also, there was a grade II-III diastolic murmur along the left sternal border. The blood pressure was 90/70 mm. of mercury, the pulse rate was 100. Crepitant rales were present in the lungs and some peripheral edema was present.

Fluoroscopy disclosed cardiomegaly involving predominantly the left ventricle. Marked calcification was present in the aortic valve area. The electrocardiogram revealed left axis deviation, left ventricular hypertrophy and first degree heart block.

Operative Procedure

On January 31, 1956, the patient's chest was entered through an anterior bilateral thoracotomy in the third interspace with a transverse sternotomy. There were numerous adhesions to the lungs bilaterally. When the peri-

cardium was opened the heart appeared enlarged and there was an easily palpable thrill in the ascending aorta in association with a well defined poststenotic dilatation of the ascending aorta. Heavy deposits of calcium were palpable at the origin of the aorta.

The aortic valvotomy was done under direct vision utilizing total cardiopulmonary by-pass with maintenance of the systemic circulation by the pump oxygenator. This technique was combined with the use of a retrograde perfusion of oxygenated blood through the coronary venous system to maintain the myocardial circulation and to prevent air embolism during the interval that the ascending aorta was open.

After heparinization of the patient, plastic catheters were inserted transauricularly into the superior and inferior cavae. Another plastic catheter was inserted into the aortic arch via the left subclavian artery for the return of arterialized blood. The pump-oxygenator was then calibrated to deliver 1800 cc. of oxygenated blood per minute to the patient via

FIGURE 2: Some Causes of Failure with Aortic Valvotomy Performed Blindly. Congenital aortic stenosis in a girl aged 6 years dying of aortic insufficiency 9 days after transventricular aortic commissurotomy. The arrow points to the false passage made by the dilator through a sinus of valsalva. A probe tip defines the true aortic valve orifice.

this subclavian artery catheter and to remove an equal quantity from the caval conduits. With the patient's catheters linked to the pump oxygenator and the caval inflow occluded by pulling up upon the previously placed encircling tapes, a short right atriotomy incision was made to expose the orifice of the coronary sinus. This sinus was cannulated with a No. 14-F plastic catheter which was anchored in place in the sinus with a silk stitch. This coronary sinus catheter was then connected to the efferent limb of the oxygenator through a separate small pump set to deliver 125 cc. of oxygenated blood per minute. Following this the aorta was cross clamped just below the origin of the innominate artery. The arch of the aorta proximal to the clamp was now rendered bloodless. After incising this segment of the aorta down to the valve ring, an excellent exposure of the aortic valve resulted. The latter was severely stenotic and had a fishmouth orifice of no more than 4 mm. Verrucous deposits of calcium surrounded this dome-shaped stenotic area. The commissures were handily opened in a tricuspid manner out to the annulus with dissecting scissors. Some of the verrucous calcium was also trimmed off and the synechia binding the cusps against the inner aortic wall were cut with the scissors tip. These procedures resulted in a valve appearing to function very satisfactorily despite its diseased state. After closure of the aortotomy the aortic cross clamp was removed. The myocardium had been nourished for 11 minutes by retrograde coronary perfusion and during this interval the heart color remained pink and had continued to beat at a slow, regular rate. The total duration of the cardiopulmonary by-pass was 15¾ minutes. The patient's temperature during the by-pass remained at 100° F. (rectally). The heart responded immediately at the conclusion of the by-pass and the blood pressure (measured by a catheter in radial artery) was 100/60 mm. of mercury within one minute after release of the cavae. The jet-like thrill palpable in the aorta before the by-pass had disappeared.

The patient's convalescence was uneventful and she was discharged after three weeks. Follow-up examination four months postoperatively revealed a sustained and effective improvement in her exercise tolerance. She was not actively performing the duties of a housewife. To date she required no diuretics and as well has been relieved completely from her angina, vertigo, and dyspnea. She could now climb stairs without difficulty whereas preoperatively this was impossible. Her blood pressure is 110/74. A grade II systolic murmur without thrill remains over the aortic area. The diastolic murmur of aortic insufficiency present preoperatively has disappeared.

Comment

Blind techniques for the relief of aortic stenosis have demonstrated that the pathologic and physiologic abnormalities associated with this lesion may at times be improved. However, the results especially in the more seriously ill patients with calcified valves and in children with congenital stenosis have shown the pressing need for superior methods. An analysis of the partial successes as well as our failures (Figures 2 and 3) has suggested that many of the problems could be obviated by a direct vision

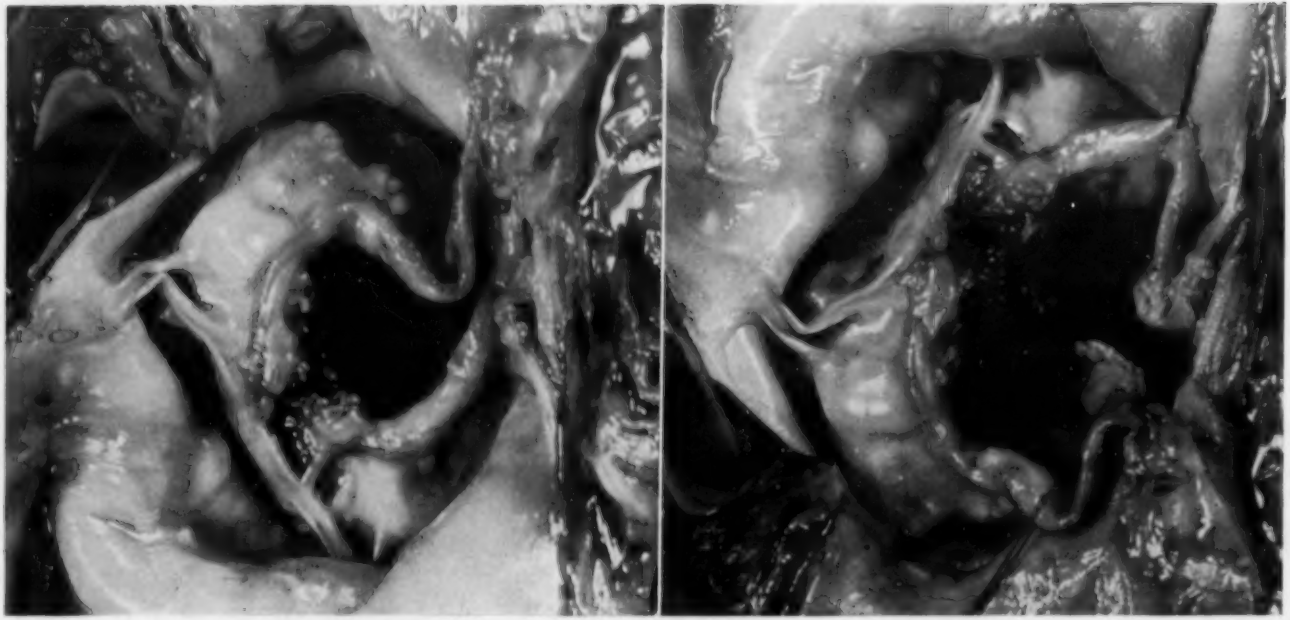

FIGURE 3A FIGURE 3B

FIGURE 3: Failure to Open More Than One Commissure in a Severely Calcified Aortic Stenosis. This 55 year old man died 6 weeks after closed transventricular aortic commissurotomy of cardiac failure due to aortic insufficiency. A. Shows valve at autopsy. Only one commissure had been opened at operation adequately by the dilator. The other two commissures although clearly definable remained sealed. B. Same valve, at autopsy, with cusps pulled part to demonstrate rigidity, although this patient's valve represents an advanced lesion, in the autopsy room a significant augmentation in the mobility of these calcified cusps resulted as soon as the other two commissures were opened out to their annulus and the synechia binding the cusps against the aortic wall were cut under direct vision.

approach which would allow the fused commissures to be opened precisely out to the annulus but without tearing the cusps, rupturing a sinus of valsalva, or permitting free calcific emboli to enter the systemic circulation.

Admittedly those markedly diseased valves cannot be restored to normal; however our study of fresh autopsy material suggests that it is possible despite the existence of calcific aortic stenosis to effect a gratifying improvement in mobility available to the aortic cusps if all three commissures are accurately opened and some of the verrucous calcific vegetations are trimmed from these diseased structures. Moreover, an important adjuvant to the success of this direct vision reparative procedure has been the recognition of the value of cutting of the old inflammatory synechia which bind the valve cusps back against the aortic wall thus restricting their function.

Another advantage inherent in the by-pass approach to the aortic valve lies in the fact that with the myocardium totally by-passed, its workload is sharply reduced so that nourishment derived from the retrograde perfusion of only a very small quantity of oxygenated blood via the coronary sinus is adequate at normal body temperature to avoid the risks of hypoxia or arrhythmias. It appears that the best direct vision approach to the aortic valve is through the ascending aorta and this avenue fortunately further spares the myocardium the trauma of a cardiotomy. Too, it eliminates the difficulty of severe hemorrhage from a ventriculotomy provoked in some patients by their very high pressure and friable heart muscle.

Clowes[9] has reported the only previous attempt to perform aortic valvotomy under direct vision with support by a pump-oxygenator system. It is perhaps significant that he records no attempt to support the myocardium by maintenance of coronary flow. During the six-minute interval that the aortic valve was exposed, the coronary circulation was completely interrupted. This patient expired and there was a failure of the heart in this case to take over adequately following the valvotomy.

In the experimental laboratory we have found that the non-working (by-passed) normal canine heart invariably goes into arrest or ventricular fibrillation upon release of the inflow after only 6 to 8 minutes of total interruption of coronary circulation at normal body temperature. The use of hypothermia will lower this threshold further. Retrograde perfusion of the coronary sinus with but a trickle of oxygenated blood we have shown will consistently protect the unloaded myocardium against this complication. Moreover, the back perfusion techniques prevent the entrance of air into the coronary arteries for the duration of the opened aorta. Measurements upon the oxygen content of the blood trickling out of the coronary artery orifices during this procedure indicate that the myocardium is taking up available oxygen. This fact is further substantiated by the healthy pink color of the heart during the test period.

SUMMARY

Blind or closed techniques for the correction of calcific aorta stenosis either through the left ventricle or the aorta have been encouraging but

not all together satisfactory. The failures or deaths have been from uncontrollable hemorrhage, ventricular fibrillation, or the creation of aortic insufficiency. The successes have all too frequently been partial and incomplete.

It is predictable that a direct vision approach to the aortic valve utilizing the pump-oxygenator would lessen or obviate many of these complications. The twin obstacles to the direct vision approach to the aortic valve (interruption of the coronary artery circulation, coronary air embolism) can be prevented by a retrograde perfusion of oxygenated blood into the coronary sinus.

In a critically incapacitated 37-year-old woman this technique was applied to the correction, under direct vision, of her calcific aortic stenosis. Total cardiopulmonary by-pass was instituted utilizing a pump and a simple disposable oxygenator. The aortic valve was exposed for 14 minutes through the opened aorta. During this interval the myocardium was maintained by the retrograde coronary sinus perfusion of a small quantity of oxygenated blood from the oxygenator. The heart remained a healthy pink color and continued to beat at a slow regular rhythm throughout this interval. Recovery was uncomplicated and the patient's status postoperatively has improved dramatically.

RESUMEN

Las técnicas ciegas o cerradas empleadas para la corrección de la estenosis aórtica calcificada a través del ventrículo izquierdo o de la aorta han sido alentadoras pero no del todo satisfactorias. Las muertes o los fracasos han debido a hemorragia incontrolable, fibrilación ventricular, o a la producción de insuficiencia aórtica. Frecuentemente los éxitos han sido incompletos.

Es posible predecir que una viá de acceso que permita controlar directamente bajo la vista a la valvula aórtica, utilizando la bomba oxigenadora, disminuirá o evitará de estas complicaciones. El doble obstáculo para el acesso directo de dicha válvula (interrupción de la circulación arterial coronaria, embolia aerea coronaria) puede obviarse mediante perfusión retrógrada del seno coronario con sangre oxigenada.

Esta técnica fue utilizada en una enferma de 37 años de edad seriamente incapacitada, para corregirle, bajo visión directa, una estenosis aórtica calcificada. El corazón y los pulmones fueron excluídos totalmente de la circulación, empleando una bomba y un oxigenador sencillo y desechable. La válvula aórtica fue expuesta durante 14 minutos mediante aortotomiá. Durante ese lapso el miocardio se mantuvo irrigado por la perfusión retrógrada del seno coronario con una pequeña cantidad de sangre oxigenada procedente del oxigenador. El corazón conservó su color rosado normal, siendo sus contracciones lentas y rit'micas durante dicho intervalo. La recuperación se llevo a cabo sin complicaciones, y el estado postoperatorio de la paciente ha mejorado dramaticamente.

RESUME

Les techniques aveugles fermées pour le traitement correctif des sténoses aortiques calcifées, utilisant la voie d'abord par le ventricule gauche ou par l'aorte, ont donné des résultats encourageants mais non entiérement satisfaisants. Les échecs ou les déces résultant de cette technique ont été dus a des hémorragies impossibles á controler, á la fibrillation ventriculaire ou á la creátion d'une insuffisance aortique. Les succés ont été trop souvent partiels et incomplets.

Il est possible de prédire qu'une voie d'abord permettant une vision directe des valves aortiques, et utilisant le systeme de pompe oxygénateur diminuerait ou méme éviterait les complications des méthodes indirectes. Les deux obstacles de la voie d'abord des valves aortiques sous vision directe (interruption de la circulation artérielle coronaire, embolisme gazeux des coronaires) peuvent etre évités si l'on procéde a une perfusion rétrograde de sàng oxygéné par le sinus coronaire.

Une telle technique fut utilisée pour pratiquer une chirurgie correctrice sous vision directe d'une stenóse aortique calcifiée chez une femme de 37 ans qui se trouvait dans un état d'invalidité critique. Une exclusion totale du coeur et des poumons de la malade fut obtenue en utilisant une pompe et un oxygenateur simple dont on peutdisposer apres l'intervention. Les valves aortiques demeurérent visibles par une ouverture de l'aorte, pendant 14 minutes. Pendant ce temps, l'oxygénation du myocarde était maintenue grace á une perfusion rétrograde per le sinus coronaire d'une petite quantité de sang oxygené provenant de l'oxygenateur. Pendant tout ce temps, le coeur conserva son aspect rosé normal et continua de battre á un rythme lent et régulier. L'évolution vers la guérison se de'roula sans complications, et l'état post opératoire de la malade s'est améliore d'une facon dramatique.

ZUSAMMENFASSUNG

Blinde oder geschlossene Methoden für die chirurgische Beseitigung der verkalten Aortenstenose durch den linken Ventrikel oder durch die Aorta sind, im ganzen betrachtet, nicht zufriedenstellend. Die Versager oder Todesfälle beruhen auf nicht kontrollierbarer Blutung, Kammerflimmern oder der Schaffung einer Aorteninsuffizienz.

Es lässt sich voraussagen, dass das chirurgische Angehen der Aortenklappe unter Sicht des Auges mit Hilfe der Herz-Lungen maschine diese Komplikationen vermindert oder beseitigt. Die beiden Hindernisse, die dem chirurgischen Angehen der Aortenklappe unter Sicht des Auges im Wege stehen, nämlich die Unterbrechung des Koronarkreislaufes und Luftembolie der Koronararterien, können beseitgt werden durch die retrogarde Perfusion durch den Koronarsinus mit sauerstoffgesättigtem Blut.

Diese Technik der chirurgischen Behandlung der Aortenstenose unter Sicht des Auges wurde angewandt bei einer 37 jährigen Frau, die infolge ihrer verkalkten Aortenstenose in einem schwerkranken Zustand war. Unter vollständiger Ausschaltung von Herz und Lungen mit Hilfe der Herz-Lungen maschine wurde die Aortenklappe durch die eröffnette Aorta fur 14 minuten exponiert. Während dieser Zeit wurde das Herz retrograd

durchströmt mit sauerstoffgesättigtem Blut aus dem Sauerstoffsättiger. Das Herz behielt ein gesundes rosafarbenes Aussehen und schlug ununterbrochen langsam und reglemässig während dieser Zeit. Die Rekonvalescenz des Pat. war komplikationslos. Ihr Zustand nach der Operation zeigte eine dramatische Besserung.

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A Prosthesis for the Palliation of Mitral Insufficiency

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Mitral insufficiency results from a failure of the valve leaflets to meet during ventricular systole. During exploratory surgery on patients afflicted with this disease, the observation was made by the authors and others[1] that the regurgitant jet could be effectively controlled by the surgeon's index finger with significant improvement in the action of the heart as long as the finger remained as an obturator in this area of valvular deficiency. This observation suggested a possible therapeutic approach to mitral insufficiency by controlled production of a relative mitral stenosis. Theoretically, this concept would appear feasible as mitral insufficiency is generally less well tolerated than is mitral stenosis in man.

Dexter[2] has calculated that the functioning mitral valve area may be reduced to two square centimeters without significant elevation of the pulmonary pressure at rest although some rise with exertion may be anticipated. Thus, if one could place a finger-like obturator through the incompetent area of a defective mitral valve such that it would properly fill the insufficient area, the lesion would be palliated provided that at least two square centimeters, or preferably more, of functioning valve area remained. Such a stationary prosthesis would not be dependent upon motion to serve its purpose, and consequently might be better tolerated by the heart and thus able to function indefinitely, especially if the prosthetic material was relatively non-reactive so that compromising adhesions did not form between it and the adjacent valve leaflets. Furthermore, this prosthesis could be shaped at the operating table to the size found necessary for control of the insufficiency. The dilated annulus characteristic of hearts with significant mitral incompetency could be expected to contract appreciably as a consequence of controlling the insufficiency,[3] therefore, to maintain maximum valve efficiency it would be desirable for the prosthesis within the mitral orifice to contract also with time at a predictable rate.

The interesting properties and the preparation of polyvinyl surgical sponge† have been described by Grindlay and Waugh.[4] These characteristics include the facts that this material can be molded to any shape, it is relatively non-reactive when inserted into the blood stream, and it will

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Supported by Research Grants from: (1) Graduate School, University of Minnesota, (2) Minnesota Heart Association, (3) Life Insurance Medical Research Foundation and (4) National Heart Institute, USPHS, (H-830).
†Ivalon Surgical Sponge (Formulation M) Clay-Adams Company, Inc., New York.

contract inversely proportional to the extent of compression upon insertion through the mitral ring. Here would seem to be a substance having a number of the desirable qualities postulated necessary for the finger-like obturator proposed above.

In this investigation preparation of the prosthesis, the technique of its insertion, and the acceptance by the heart of the prosthesis over the period of study, which was up to ten months, received particular emphasis.

Method of Study

For these experiments the poylvinyl sponge was compressed in several variations from its original texture. This was accomplished by carving cylinders of polyvinyl sponge larger than a cylindrical mold depending upon the amount of compression desired. The mold containing the sponge was then boiled which served to sterilize, compress, and shape the prosthesis. After cooling in the mold the sponge would retain the shape and compression imposed.

Two designs of the prosthesis were used in this study. The first was fusiform shaped and constructed so that its maximum diameter would lie at the annulus. After several experiments it was empirically thought better to minimize the amount of the obturator in the atrium. As a result the second design was tried. This took the shape of an inverted cone with its apex attached to the posterior papillary muscle and the base constructed to lie at the level of the annulus. A narrow protrusion of sponge extended from the base of the cone and was placed across the posterior commissure to serve as the atrial attachment of the prosthesis. In each instance the prosthesis was measured accurately before insertion and again at autopsy.

Clean but not sterile surgical technique was employed on the normal healthy mongrel dogs used in this project. The left chest cavity of the dog in each experiment was opened in the fifth interspace with the aid of pentothal anesthesia and positive pressure mechanical respiration using an endotracheal tube. The pericardium was incised anterior to the phrenic nerve, and then sutured to the chest wall which served to retract the lungs and provide a wide unhampered operative site. Next a purse string suture was placed around the base of the left auricular appendage or in the smaller animals it was placed partially on the left atrium proper. The auricular appendage was then opened on its anterior surface from its tip toward the atrium as far as necesary to admit an index finger. By this approach auricles even in the smallest dogs were of ample size to permit completion of the procedure in the usual manner.

The operator's finger having been introduced into the left auricular appendage and through the mitral orifice, the left ventricular cavity was explored and the posterior papillary muscle located. At this juncture in those animals selected to have a traumatically induced mitral insufficiency, a small hooked knife was introduced through the appendage, and the mural leaflet of the mitral valve was lacerated. The exact location and extent of the laceration was difficult to determine even with the finger as a guide,

and in the first attempts the aortic leaflet or chordae tendineae were inadvertently injured. These injuries were poorly tolerated by the animals. In the remaining animals the prosthesis was inserted into normal mitral valves.

For insertion of the prosthesis, a four inch slightly curved round needle carrying a doubled 00 silk suture was passed into the left ventricle in such a manner that emerged within the chamber just below the insertion of the chordea tendineae on the posterior papillary muscle. The point of the needle was palpated with the tip of the index finger inside the left ventricle and the needle guided through the mitral orifice and out of the incision in the left atrial appendage. This resulted in a doubled suture in place through the left chambers of the heart.

For the atrial attachment of the obturator a second needle and suture similar to that above is passed through the left atrial wall just below the right pulmonary vein as it enters the atrium and just above a dimple* which is consistently present in the dog. The suture is carried through the atrium and out the incision in the appendage. This suture will place the atrial attachment of the prosthesis about one centimeter above the posterior commissure, next to the junction of the atrial septum with the posterior atrial wall and just below the right inferior pulmonary vein. The external distance between the entrance into the heart of the ventricular and atrial sutures was then measured, and the previously prepared polyvinyl sponge cut to this length. The prosthesis was then trimmed with a scissors to one of the previously described shapes. The maximum diameter of the prosthesis would be made to lie between two and three centimeters from the end intended for attachment to the posterior papillary muscle. This placed the maximum diameter of the prosthesis in the mitral valve orifice at its posterior commissure.

The sutures extending out of the atrial appendage were then sutured to the ends of the prosthesis with the stitches buried in its substance. The prosthesis was then introduced into the heart and positioned as a stationary finger-like obturator at the posterior commissure. The ends of the prosthesis were pulled tight to the endocardium but not through it, after which the transfixing sutures were sewed to compressed polyvinyl sponge buttons on the epicardium. This firmly fixed the intracardiac prosthesis in the desired place. The auriculotomy was repaired and the chest incision closed. All animals were given antibiotics for five days following surgery.

Results

Twenty-nine animals were included in this study of which 28 have died or were sacrificed at intervals from the day of surgery up to 10 months

*This marks the location of the coronary sinus at the junction of the intra-atrial septum and the left atrial wall posteriorly. It very closely approximates the external projection of the posterior commissure. A persistent left superior vena cava, of which we have seen one example in the dog, enters the heart at this point. No description of this dimple was found in veterinary anatomy books or literature, but it serves as a good landmark for this study.

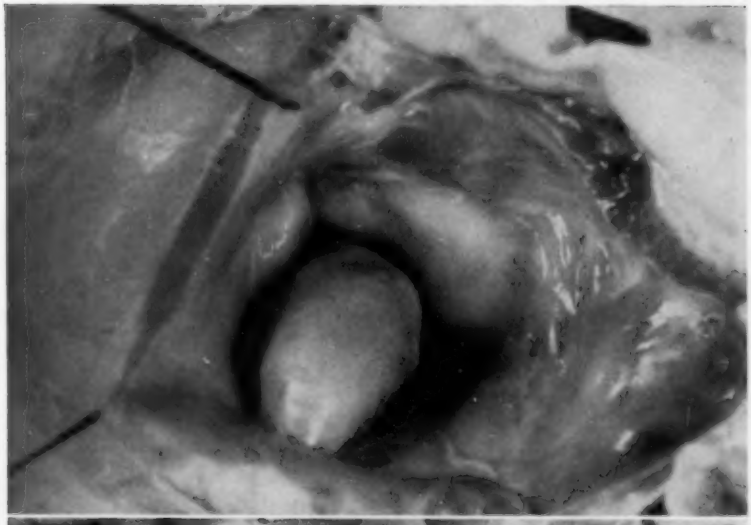

FIG. 1

FIG. 2

Figure 1: A polyvinyl fusiform prosthesis acting as an obturator in the mitral orifice as viewed from the left atrium during simulated ventricular systole 90 days after insertion. The prosthesis has healed smoothly to the left atrial wall, and is covered by a smooth layer of fibrous tissue.—*Figure 2:* This is the same specimen as pictured in Figure 1. The left ventricle is opened through the anterior commissure of the mitral valve. The darker areas on the prosthesis represent the area in contact with the mitral leaflets. The fibrin coat is not as thick in these areas. Note how the prosthesis was shaped by the pressure of the leaflets. No adhesions are present. The cross sectional area at the annulus has contracted to 25 per cent of its original area.

later. The one remaining animal is still alive for observation over a longer time interval.

A traumatically induced mitral insufficiency was produced in 12 of these animals. A fusiform mitral obturator was placed in nine of these and the conical prosthesis placed in three. Eight died at intervals from the day of surgery to 120 days later while the other four were sacrificed (see below). Of the eight that died, two died the first day as a result of technical errors, two died from bacterial endocarditis proven by positive blood cultures, and three died a month or more after their operation from infected pulmonary edema associated with evidence of systemic infection either pyelonephritis or verrucous valvular lesions. The cause of death in the eighth was central nervous system emboli which apparently had originated from the base of the conical prosthesis used in this animal. The conical prosthesis mentioned previously was used in three of the eight animals that died and in none that survived. This shape was not well tolerated by the hearts and clots tended to form on the base of the prosthesis. This conical obturator did not develop a good even coating of fibrin that was generally present on the fusiform prosthesis. All three with the cone shaped prosthesis also had some associated infection.

Four of the 12 animals with induced mitral insufficiency were apparently in good health when sacrificed over 200 days after their operation. Two had had a positive blood culture after their postoperative recovery period, and each had a small organizing clot on the atrial portion of their prosthesis found at autopsy. The other two animals tolerated the trans-mitral obturator well and were in good health when sacrificed.

The prosthesis seemed to reduce or obliterate the traumatically induced mitral insufficiency, however, eight of these 12 animals developed some complication involving sepsis before death. It is obvious then that the prosthesis did not protect the animals from this complication of acute mitral insufficiency.

The fusiform prosthesis was placed in the hearts of 13 animals whose mitral valve was not injured while the conical prosthesis was placed in the hearts of three other normal animals. In the group of 13 one died as a result of a technical error and another died one week after surgery due to heart failure which was caused by a large interatrial septal defect. The atrial attachment of his prosthesis was placed too far medially, the atrial suture penetrated the septum and was anchored through the right atrial wall. The action of the heart apparently caused the prosthesis to erode through the septum creating a large defect. All of the remaining 11 animals were in good health until sacrificed at intervals up to ten months. The prosthesis was well tolerated in each and all had apparently avoided any infectious process.

The three normal animals in which the conical obturator was placed died, two as a result of bacterial endocarditis and one of distemper. All three had positive blood cultures before their death.

Figures 1 and 2 represent the optimum response of the animals to the fusiform shaped prosthesis as represented by the group of 11 animals

mentioned above. It may be noted in Figure 2 how the leaflets conform to the shape of the prosthesis, and how the pressure of the leaflets in ventricular systole have ultimately shaped the polyvinyl sponge. The ventricular and atrial portions of the sponge contracted very little after placement within the heart. The sponge seems to retain the same degree of softness as was present upon introduction into the heart, except for the central area which becomes more firm with contraction. The mitral leaflets did develop some thickening in the portions which coapted with the prosthesis. A couple millimeters of the chordae tendineae at their insertion on the posterior papillary muscle were often involved in the healing process with the prosthesis, however, no adhesions were ever present between the leaflets and the obturator. Six weeks was about the time necessary for the prosthesis to become well covered by a fibrin coat, and for most of the contraction to take place.

The surfaces of the prostheses were smoothly covered by a thin white layer. The areas of the prosthesis which coapted with the leaflets were the last to become well coated, and as Figure 2 demonstrates by the darker areas, the fibrin layer was thinner in these regions. Microscopically the surface of the polyvinyl sponge was a fibrin jacket which was firmly growing into the interstices of the sponge. The fibrin seemed to develop into collagen and no true endothelium was found. The remainder of the sponge was similar microscopically to that described by Johns and Blalock.[5] Small capillaries invaded the prosthesis from each end and the general appearance was that of organizing clot interspersed with strands of polyvinyl sponge.

Compression of the polyvinyl sponge was determined by measuring how much the diameter of the sponge cylinder was reduced after molding. Polyvinyl sponge cylinders whose diameters were compressed from two to one or more, retained their original form within the heart with healing and time, the impact of the leaflets having very little effect on the ultimate shape of the prosthesis. Sponge cylinders compressed from one and one-half diameters to one, contracted in cross sectional area in the portion shaped by the leaflets by about fifty per cent. Cylinders not compressed contracted in cross sectional area to about twenty-five per cent. The sponge in all compressions seemed to be tolerated by the dogs' hearts equally well.

Discussion

Even a mild degree of acute traumatic mitral insufficiency was not tolerated well in the animals used for this study. The very high incidence of infection in those animals with acute mitral insufficiency in spite of antibiotics after placement of their prosthesis is noteworthy as infection was not the same problem in the control group. This may be related to previous observations[6] which demonstrated the fact that a chronically increased work load on the heart of a dog predisposes that animal to infections and especially bacterial endocarditis. This would seem to offer an explanation for the high incidence of infection in these animals.

The streamlined (fusiform) design of the prosthesis was better tolerated in the animals used for these experiments, even in some that developed septic conditions associated with acute mitral insufficiency.

One can not compare the pathology of acute traumatic mitral insufficiency in the dog with human rheumatic mitral insufficiency, consequently the human applications of this study must be surmised.

For possible clinical use a prosthesis that would be able to contract up to fifty per cent probably would be desirable. The portion through the annulus will contract as a result of pressure by the valves, while the remainder will retain much of its original size. The action of the valves are the determining factor in the ultimate size of the prosthesis. As the regurgitation is controlled, a dilated annulus will regress. This will cause the leaflets to more closely approximate, which will make the prosthesis contract to the area of the remaining insufficiency. If the original insufficiency area is reduced less than fifty per cent when the regression of the dilated annulus is complete the contraction of the prosthesis would be arrested as the pressures of the leaflets would no longer be exerting a force on the obturator. The insufficient area of the valve would then be filled and the leaflets free to move unobstructed.

SUMMARY

A polyvinyl sponge is used experimentally to straddle the posterior commissure of the mitral valve in the dog. This material will contract and be shaped as the pressures of the mitral leaflets dictate and thus tend to fill any area of valve deficiency that is present. The clinical implication is that this technique may be used to reduce the quantity of regurgitation present in humans with significant degrees of mitral insufficiency.

RESUMEN

Se usa una esponja de polivinil experimentalmente para mantener abierta la comisura posterior de la válvula mitral en el perro.

Este material se contrae y se amolda a las presiones de las hojillas de la mitral y así tiende a llenar cualquiera área de deficiencia que existan.

La consecuencia clínica es que esta técnica puede usarse para reducir el volumen de la regurgutación en los humanos con grados significantes de insuficiencia mitral.

RESUME

Les auteurs ont utilisé expérimentalement une éponge de polyvinyle pour élargir la commissure postérieure de la valvule mitrale chez le chien. Cette matière se contracte et se modèle en fonction de la pression des valves mitrales et de là tendra à suppléer toute déficience de la valvule. On peut en déduire que ce procédé est utilisable pour réduire le reflux sanguin chez l'homme atteint d'insuffisance mitrale même assez importante.

ZUSAMMENFASSUNG

Im Experiment wird ein Polyvenylschwamm benutzt, um beim Hund die hintere Kommissur der Mitralklappe zu dehnen. Dieses Material wird zusammengezogen und geformt, wie es der Druck der Mitralsägel bestimmt, und neigt dazu, etwa vorliegende Klappendefekte auszufüllen. Die klinische Folgerung daraus besteht darin, dass diese Technik geeignet sein könnte, um die Stärke des Rückflusses zu mindern, die bei Personen mit schwereren Graden von Mitralinsuffizienz vorkommen.

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Environmental Causes of Cancer of the Lung Other Than Tobacco Smoke

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The recognized or strongly suspected environmental causes of cancer of the respiratory system form an important segment of the environmental carcinogenic spectrum.

1. With one exception all so far known exogenous respiratory carcinogens were discovered during the last 25 years (Table I), that is, during the period in which a remarkable and progressive rise in the number and frequency of cancers of the lung was observed in most industrialized countries (Fig. 1).

2. The various respiratory carcinogens are more or less well defined chemical or physical agents and/or are associated with distinct occupational activities engaged in by circumscribed workers groups (Table II).

3. The clinical, epidemiologic, pathologic and experimental observations related to these agents all of which act through the respiratory route

TABLE I

OCCUPATIONAL RESPIRATORY CARCINOGENS AND CANCERS RECORDED DURING PAST 75 YEARS; THEIR CAUSES, SITES AND NUMBERS

Agent	Site of Cancer	Discovered	Number of Recorded Cases		
			U.S.A.	Other Countries	Total
Arsenic	Lung	1930	7	16	23
Asbestos	Lung	1934	20	92	112
Chromates	Lung	1932	75	65	140
Nickel	Lung	1932	0	84	84
	Nares and Nasal Sinus		0	51	51
Coal Tar	Lung	1936	0	53	53
Petroleum Oils	Lung and Larynx	1936	7	33	40
Isopropyl Oil	Lung	1946	1	0	1
	Larynx		4	0	4
	Nasal Sinus		6	0	6
Radioactive	Lung	1879	0	625	625
Chemicals	Nasal Sinus	1931	3	0	3
	TOTAL		123	1,019	1,142

National Cancer Institute; National Institutes of Health; Public Health Service; U. S. Department of Health, Education and Welfare.

Presented at a Symposium, 21st Annual Meeting, American College of Chest Physicians, Atlantic City, New Jersey, June 2, 1955.

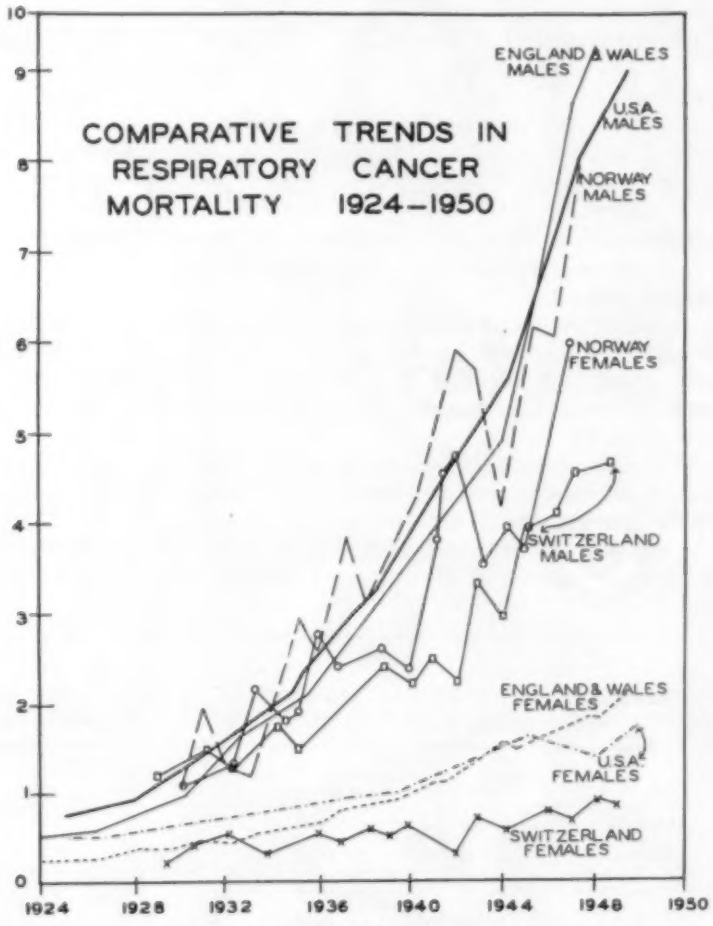

FIGURE 1

TABLE II—SPECIFIC WORKER GROUPS WITH SPECIFIC RESPIRATORY CANCER HAZARDS

Agent	Worker Groups
Arsenic	Manufacturers, handlers, and users of arsenical insecticides; arsenic smelter workers; taxidermists; sheep dip workers; copper smelter workers
Chromium	Chromate manufacturers including plant maintenance workers; chrome pigment handlers
Nickel	Nickel-copper matte refinery workers
Iron	Iron ore (hematite) miners ?
Radioactive Substances	Radioactive ore (pitchblende) miners; miners of nonradioactive ores working in radioactive mines
Isopropyl Oil	Isopropyl alcohol manufacturers
Coal Tar Fumes	Coke oven operators; gas house retort workers
Petroleum Oil Mists	Paraffin pressers; mule spinners; metal lathe workers and drillers

represent the only reliable factual evidence available on the causation of cancers in different parts of the respiratory tract (Table III). Although some occupational, medicinal and experimental observations suggest that pulmonary carcinogenesis may ensue after a non-respiratory contact with carcinogens, there exists no valid evidence incriminating hereditary or endogenous factors as primary causal agents of human lung cancer.

Despite the fact that the total number of occupational pulmonary cancers on record is relatively small, the comparatively high cancer attack rates observed among the different worker groups studied provide weighty evidence in favor of actual causal associations between an exposure to the specific agents and the subsequent development of respiratory cancers (Table IV). The reported number of cases of occupational respiratory cancers doubtlessly represent only a fraction of the total number which

TABLE III

ENVIRONMENTAL LUNG CANCER SCORE BOARD

	Site of Cancer				Population Affected			Type of Evidence			Experimental Evidence	
	Lung	Larynx	Nasal sinus & cavity	Nonrespiratory organs	Occupational	General	Conclusive	Circumstantial	Suggestive	Negative	Lung	Other organs
Arsenic	x			Skin	x	?	x					
Asbestos	x				x	?	x				x	
Beryllium	x					?		x			x	Bone
Chromium	x				x	?	x				?	Bone Conn. tissue
Nickel	x		x		x		x					Bone Conn. tissue
Iron	x				x				x			
Radioactive Substances	x		x	Skin Bone Hemat. tissue Conn. tissue	x		x				x	Bone Conn. tissue Hemat. tissue, etc.
Isopropyl oil	x	x	x		x		x					
Polycyclic Hydrocarbons coal tar, soot, pitch	x	x		Skin	x	?	x				?	Skin Conn. tissue, etc.
Petroleum Derivatives oil mist	x	x		Skin	x			x				Skin Conn. tissue
Gasoline Diesel engine Exhaust	x				x	?		x				Skin
Gasoline Epoxides						?			?			Skin

TABLE IV
RESPIRATORY CANCER ATTACK RATES BY ENVIRONMENTAL CARCINOGENS

Agents	Sites of Cancers	Incidence in Population at Risk	Percent of All Cancer Deaths	Attack Rates: Morbidity Rate (Per 100,000)	Attack Rates: Mortality Rate (Per 100,000)
Aromatic hydrocarbons:					
Coal tar fumes	Lung	500:100,000	45%	.....	.....
Petroleum oils	Lung	2000:100,000	55%	.....	.....
Carbon and silicon polymers: Isopropyl oil	Paranasal sinuses, Larynx	10:100	.....	134.5 (normal 6.5)	.....
Asbestos	Lung	.....	.....	.....	13.2-20% asbestosis autopsied (0.8-2.4% normal)
Metals:					
Arsenic	Lung	.....	.....	.....	145.7 males (10.9 normal)
Chromates	Lung	.....	.....	(42x normal)	146-338
Nickel	Nares	329:100,000	.....	.....	.....
	Paranasal sinuses			(20x	
	Lung	574:100,000	.....	normal)	.....
Ionizing radiation:					
Radioactive area	Lung	.....	.....	.....	(50-80% of all deaths)

occurred. Some of the lung cancers were certainly mistaken for tuberculosis, pulmonary abscesses, silicosis, asbestosis, siderosis or other forms of chronic pulmonary disease. Another portion of these tumors was recognized as of occupational origin but not made a matter of public record, while a third fraction developed in workers many years after they had left the hazardous occupation and when the causal relations to their previously sustained exposures had been obscured by the passage of time (Table V. Page 156).

The almost exclusive occurrence of occupational lung cancers in male

TABLE VI
LATENT PERIODS OF ENVIRONMENTAL RESPIRATORY CANCERS

Agent	Lung: Average Latent Period	Lung: Range of Latent Period	Nares & Nasal Sinuses: Average Latent Period	Nares & Nasal Sinuses: Range of Latent Period
Asbestos	18	15 - 48	....	....
Chromates	15	5 - 47	....	....
Nickel	22	6 - 30	11	3 - 26
Tar fumes	16	9 - 23	....	....
Isopropyl oil	....	....	10	6 - 16
Ionizing radiation	25 - 35	7 - 50	25	19 - 32

workers is in good agreement with the fact that males are predominantly employed in occupations having lung cancer hazards. One of the known exceptions in this respect are the lung cancers found in female asbestos workers. The male-female ratio of lung cancers among workers with asbestosis cancer of the lung is for this reason at the low level of 2.3:1, indicating that with an equalization of the degree of exposure there

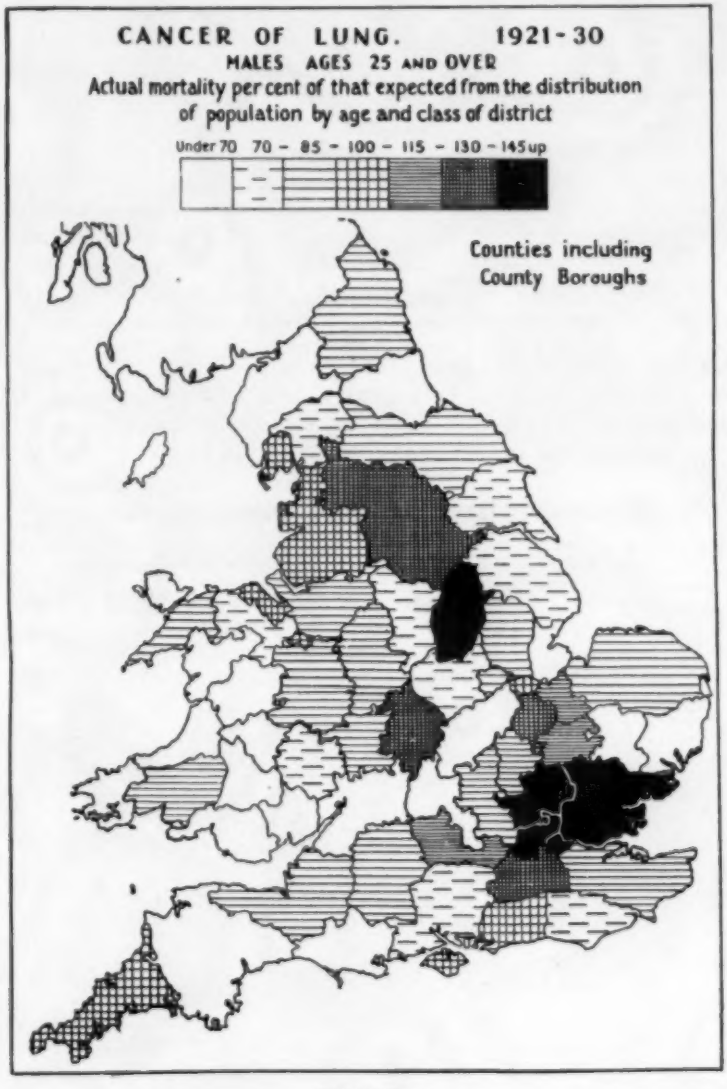
CANCER OF LUNG. 1921-30
MALES AGES 25 AND OVER
Actual mortality per cent of that expected from the distribution of population by age and class of district
Under 70
70 - 85 - 100 - 115 - 130 - 145 up
Counties including County Boroughs

FIGURE 2
(Reproduced by permission of the British Empire Cancer Campaign.)

TABLE VII

HISTOLOGIC TYPES OF OCCUPATIONAL RESPIRATORY CANCERS

Agent	Organ	Squamous Cell Carcinoma With or Without Cornification	Bound Cell or Cat Cell Carcinoma	Anaplastic or Polymorphic Carcinoma	Adeno-carcinoma
Tar Fumes	Lung	3	....	....	2
Nickel	Lung	4	....	3	....
Chromium	Lung	....	2	....	....
Asbestos	Lung	11	2	2	6
Radioactive Gases & Dust	Lung	14	9	7	1
Nickel	Nares and Nasal Sinus	3	....	6	1
Radioactive Gases & Dust	Nares and Nasal Sinus	33	....	....	....
Isopropyl Oil	Nares and Nasal Sinus	....	....	4	....

develops a tendency toward an equalization of liability to lung cancer.

Several types of industrial lung cancers, such as those caused by radioactive substances, chrome pigments, and coal tar fumes, show a definite shift into younger age groups than those observed in cancers of the lung

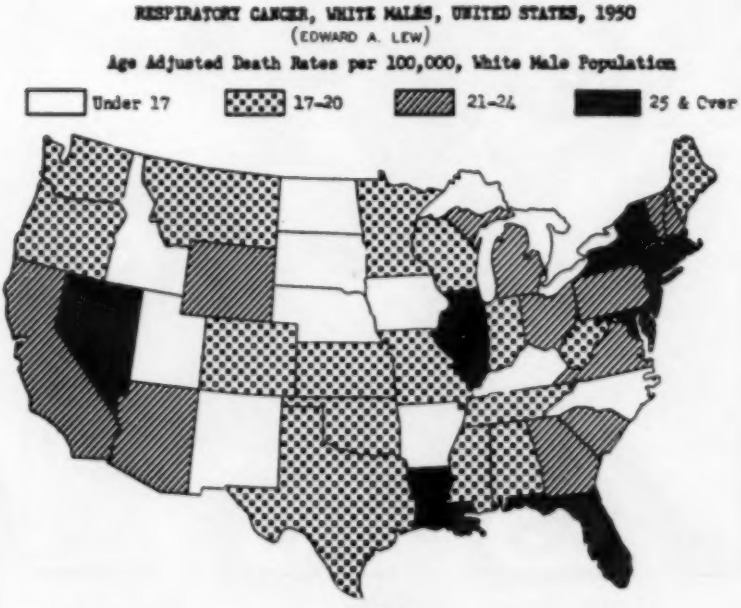

FIGURE 3

of cryptogenetic origin, but characteristic of cancers of occupational etiology.

Occupational respiratory cancers moreover have long latent periods like other cancers of known industrial or environmental origin (Table VI). The relatively massive exposure to carcinogens not infrequently prevailing under occupational conditions may perhaps account for the fact that a multicentric genesis of several types of occupational lung cancer, i.e. asbestosis cancer and radioactive cancer, is not infrequently observed. Pulmonary fibrosis associated with silicosis in radioactive ore miners or with siderosis in hematite miners seems to decrease the individual liability to cancerous developments in the lungs thus affected. While many occupational lung cancers are of squamous cell type, many others display an inmature or round cell type or exhibit glandular structures. In fact, several different histologic types of cancers may occasionally occur in the same tumor mass (Table VII). Thus, no special histologic type seems to have any fixed relation to any specific causal factor. Occupational respiratory cancers critically studied exhibit a general symptomatic pattern common to and characteristic of environmental cancers.

4. Many of the agents incriminated in occupational respiratory carcinogenesis, such as arsenicals, radioactive substances, coal tar and petroleum oils, had previously been known as important causes of occupational and medicinal cancers of the skin developing usually upon cutaneous exposure. Since the mucosa of the respiratory tract may be considered as an inverted, but specialized entodermal extension of the ectodermal outer lining of the

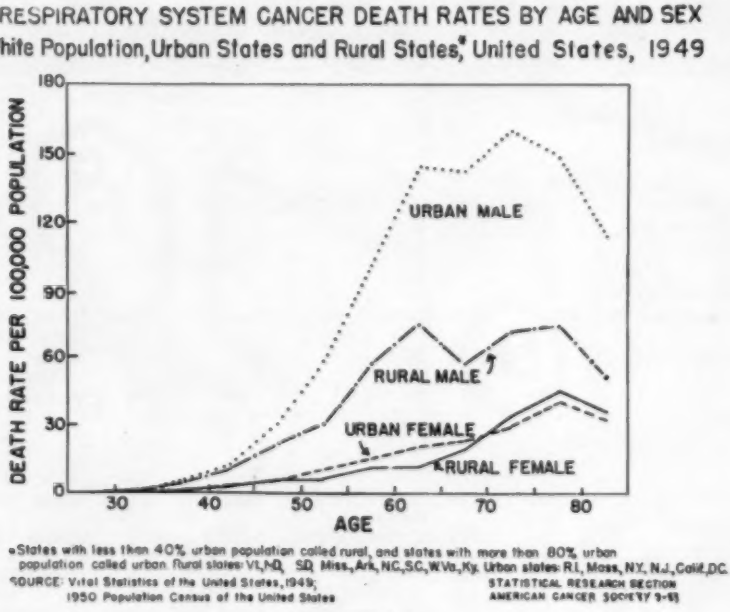
RESPIRATORY SYSTEM CANCER DEATH RATES BY AGE AND SEX
White Population, Urban States and Rural States,* United States, 1949
DEATH RATE PER 100,000 POPULATION
180
150
120
90
60
30
0
30
40
50
60
70
80
AGE
URBAN MALE
RURAL MALE
URBAN FEMALE
RURAL FEMALE
*States with less than 40% urban population called rural, and states with more than 80% urban population called urban. Rural states: Vt, N.D., S.D., Miss., Ark., N.C., S.C., W.Va., Ky. Urban states: R.I., Mass., N.Y., N.J., Calif., D.C.
SOURCE: Vital Statistics of the United States, 1949; 1950 Population Census of the United States
STATISTICAL RESEARCH SECTION AMERICAN CANCER SOCIETY 9-51

FIGURE 4

TABLE VIII

THE TIME TABLE OF DISCOVERIES OF OCCUPATIONAL CANCERS

Name of Agent	Date	Discoverer	Organs Affected	Nature of Exposure
Chemicals: Organic				
Soot	1775	Pott	Skin (Scrotum)	Occupational
Coal Tar (Lignite)	1876	Volkmann	Skin	Occupational
Coal Tar (Bituminous)	1892	Dutlin	Skin	Occupational
Coal Tar (Anthracite)	1910	Zweig	Skin	Occupational
Coal Tar (Fumes)	1936	Kaushata	Lung	Occupational
Creosote Oil	1920	O'Donovan	Skin	Occupational
Anthracene Oil	1908	Oliver	Skin	Occupational
Paraffin Oil (Shale Oil)	1876	Bell	Skin	Occupational
Petroleum Still Coke	1890	Derville and Guermongrez	Skin	Occupational
Petroleum Paraffin Oil	1910	Schamberg	Skin	Occupational
Petroleum Lubricating Oil	1930	Heller	Skin	Occupational
Shale Lubricating Oil	1910	Wilson	Skin	Occupational
Benzol	1928	Delore and Borgmano	Blood Forming Tissues	Occupational
Aromatic Amines (Dye Intermediates)	1895	Rehn	Bladder, Ureter Kidney	Occupational
Isopropyl Oil	1946	Hale and Hueper	Nasal Sinuses, Larynx Lung	Occupational
Mustard Gas	1953	Yamada, Hirose & Miyamishi	Lung	Occupational
Chemicals: Inorganic				
Arsenic	1822	Paris	Skin	Occupational
	1887	Hutchinson	Skin	Medicinal
	1930	Saupe	Lung	Occupational
Asbestos	1935	Lynch & Smith	Lung	Occupational
Chromates	1935	Pfeil	Lung	Occupational
Nickel	1932	Grenfell	Nasal Cavity & Sinuses, Lung	Occupational
Physical Agents:				
Ultraviolet Radiation	1894	Unna	Skin	Occupational Environmental
Roentgen-Radiation	1902	Frieben	Skin	Occupational
	1906	Wyes	Skin	Medicinal
	1911	Von Jagic, Schwartz & von Siebenrock	Blood Forming Tissues	Occupational
	1922	Beck	Bone	Medicinal
Radioactive Substances	1879	Haerting & Hesse	Lung	Occupational
	1923	McNeal, Ward & Willis	Skin	Occupational
	1923	Loewy	Blood Forming Tissues	Occupational
	1931	Martland	Bone	Occupational

TABLE IX

LUNG CANCER DEATH RATE PER 1,000 DEATHS OF ALL CAUSES FOR SEVEN (7) INDUSTRIAL GROUPS IN OHIO, 1947 AMONG 5,309 MALE CANCER DEATHS (MANCUSO)

Industry	Respiratory Cancer
Iron and steel	2.18
Transportation	2.91
Agriculture	0.82
Rubber and plastics	2.34
Stone, clay, glass	0.66
Non-ferrous metal	3.22
Mining and quarrying	1.53
TOTAL	1.76

body, the development of cancers from these structures following a respiratory contact with the mentioned exogenous carcinogens appears to be a phenomenon in line with previous experience (Table VIII).

5. Although the existing factual data on occupational respiratory carcinogens are at present limited to relatively restricted worker groups and apply to a comparatively small number of cancers of the respiratory organs, a considerable amount of circumstantial evidence suggests that identical or similar respiratory cancer hazards may prevail for much larger worker groups having occupational contacts with the known carcinogens. Epidemiologic studies on lung cancer death rates made in this country and Europe have shown the existence of marked variations in the liability to lung cancer for different large occupational groups (Table IX). Some of them revealed a definitely excessive frequency of pulmonary cancer (Table X, XI, and XII) as well as of cutaneous cancer. The possible significance of these observations in terms of occupational lung cancer hazards is evident from the fact that there are over 5,000,000 employed in American industries sustaining various degrees of exposure to combustion, distillation and cracking products of coal, petroleum and other carbonaceous matter (soot, carbon

(Continued on page 155)

TABLE X

LUNG CANCER FREQUENCY AMONG OPERATING AND NON-OPERATING RAILROAD WORKERS

Railroad	Period	Total No. Lung Cancers	Lung Cancers Operating RR Workers		Lung Cancers Non-Operating RR Workers		Lung Cancers Undetermined RR Workers	
			No.	Per Cent	No.	Per Cent	No.	Per Cent
A	1940 - 1950	29	24	83	5	17	....	....
B	1939 - 1949	104	59	57	15	14	30	29

There were four times as many non-operating RR workers in one company as operating ones, who represented train personnel, round house and track workers.

TABLE XI

OCCUPATIONAL GROUPS WITH AN EXCESSIVE LUNG CANCER INCIDENCE

Occupational Group	Potential Respiratory Carcinogens	Investigator
Metal workers, welders, grinders and polishers, wire makers, tool and die makers, foundry workers, metal moulders, lathe workers, etc.	Metal dust, lubricating oil mist	Borst; Kennaway and Kennaway; Turner and Grace; Mueller; Dublin and Vane, Wynder and Graham; McLaughlin; Brealow et al.
Cigar manufacturers and tobacconists	Tobacco dust, insecticides, soot	Seyfarth; Borst; Kennaway; Enger; Veraluya, Brinkmann
Engineers, mechanics, machinists, plumbers, etc.	Metal dust, soot, lubricating oil	BECC* 1944 & 1952: Gillespie; Turner and Grace; Mueller; Wynder and Graham
Painters, and decorators	Metal pigments, coal tar dyes, carbon black, asphalt paints, solvents, vehicles (lacquers, resins synthetic plastics)	BECC 1944; Mueller; Dublin and Vane; Fulton; Wynder and Graham
Tar workers, road workers, asphalters, paviours, stokers, patent fuel workers, furnace men, foundry laborers, rollers, etc.	Tar and pitch fumes and dust, soot	Kennaway and Kennaway; Fulton; BECC 1952 Registrar-General (1938); McLaughlin

*Report of the British Empire Cancer Campaign.

TABLE XII

LUNG CANCER MORTALITY IN SEVERAL COUNTIES OF MONTANA 1947-1948 (LULL AND WALLACH)

County and Total Population 1940	Major Industry	Number Lung Cancers			Total Cancer deaths	Per Cent Lung Cancer		Annual Lung Cancer Death Rate per 100,000	
		Male	Female	Total		Male	Female	Male	Female
Deer Lodge 13,627	Copper Smelting	21	0	21	98	30.8	0.0	145.7	0
		....	....	....	....	....	....	....	....
Silver Bow 53,207	Copper Mining	27	2	29	259	22.6	1.5	48.6	3.9
		....	....	....	....	....	....	....	....
Cascade 41,499	Copper Mining Smelting	20	5	25	299	12.7	3.5	46.3	12.3
		....	....	....	....	....	....	....	....
		....	....	....	....	....	....	....	....
Gallatin 18,269	Agriculture	1	0	1	81	3.0	0.0	5.2	0
		....	....	....	....	....	....	....	....

The estimated crude death rate for lung cancer among white males in the entire United States in 1947 is 10.9 per 100,000 population.

The workers employed in copper ore mining and smelting inhale dust and fumes of arsenic contained in the ore and released as a by- and waste-product during the smelting process.

TABLE XIII

LUNG CANCER MORTALITY RATES IN AUSTRIA PER 1,000 DEATHS
(J. HERBICH AND R. NEUBOLD)

Community	Total	Males	Females
Vienna	32.7	59.0	7.8
Cities 60,000 - 1,000,000	18.2	31.6	5.0
Cities 20,000 - 60,000	18.4	32.3	3.9
Rest of Austria	10.3	17.3	3.7

TABLE XIV

CANCER OF THE LUNG AND LARYNX, ENGLAND AND WALES
1946 - 1949 (KENNAWAY AND KENNAWAY)

	Lung Cancer Ratio-Number of Persons Producing One Death		Larynx Cancer Ratio-Number of Persons Producing One Death	
Type of Community	Male	Female	Male	Female
Greater London	100	100	100	100
County Borough	129	137	125	55
Other Urban Districts	160	156	148	59
Rural Districts	233	185	170	42

TABLE XV

STANDARDIZED MORTALITY RATIOS* FOR LUNG CANCER MORTALITY OF SELECTED SITES IN URBAN AND RURAL COUNTIES OF OHIO, WHITE MALES, 25-64 YEARS

(MANCUSO, Th. F., MacFARLANE, E. M. AND PORTERFIELD, J. D.)

Cancer Site and Years Included	Right Metropolitan Counties**	Seven Other Urbanized Counties***	Rural Counties****
Lung, 1947 - 1951	122.9	81.8	68.6

*Ratio—$\frac{\text{Observed Deaths}}{\text{Expected Deaths}} \times 100$

**Metropolitan County: Counties with cities of 100,000 or more in 1950 (91 per cent urban).

***Urban County: Counties with cities with populations between 50,000 and 100,000 in 1950 (66.2 per cent urban).

****Rural County: Counties with communities with populations below 50,000 in 1950 (41.4 per cent urban), comprising 73 counties.

TABLE XVI
LUNG CANCER DEATH RATES IN 25 STATES OF THE UNITED STATES IN 1946 AND 1948
CRUDE DEATH RATES PER 100,000

INDUSTRIALIZED STATES

State	1946	1948
Connecticut	8.5	11.1
Illinois	8.1	8.2
Maryland	6.5	8.4
Massachusetts	10.4	10.2
Michigan	5.7	7.1
New Hampshire	7.4	10.1
New Jersey	9.7	9.7
New York	10.2	11.9
Ohio	6.0	7.3
Pennsylvania	6.7	8.4
Rhode Island	8.7	7.4

STATES WITH REGIONAL INDUSTRIALIZATION

State	1946	1948
Florida	6.8	7.4
Louisiana	6.5	8.5
Missouri	7.3	9.4
Montana	10.0	8.8
Nebraska	5.7	8.0

AGRICULTURAL STATES

State	1946	1948
Alabama	4.0	5.1
Arkansas	3.6	5.4
New Mexico	2.6	3.0
North Carolina	3.1	4.0
North Dakota	5.6	4.1
Oregon	4.1	4.4
South Carolina	3.6	3.7
Washington	5.1	4.2
Wyoming	4.9	3.9

The death rates for the year 1946 were taken from "The American Cancer Society, Inc., 1949, Cancer Death Rates for each State in the United States by Site" (3); those for the year 1948 were produced by the National Office of Vital Statistics.

TABLE XVII

LUNG CANCER MORTALITY AND POPULATION DENSITY (STOCKS)
ENGLAND

Groups of adjacent towns with over 200,000 occupied dwellings:	
London and Suburban Area	156
Birmingham and Suburban Area	134
Manchester and Suburban Area	159
Liverpool and Suburban Area	162
Leeds and Suburban Area	132
Sheffield with 124,000 occupied dwellings	135
Newcastle and Gateshead with 87,000 occupied dwellings	114
Aggregate of 6 towns with 50,000 to 85,000 occupied dwellings	113
Aggregate of 3 towns with 40,000 to 50,000 occupied dwellings	107
Aggregate of 12 towns with 30,000 to 40,000 occupied dwellings	104
Aggregate of 13 towns with 20,000 to 30,000 occupied dwellings	100
Aggregate of 29 towns with less than 20,000 occupied dwellings	89

TABLE XVIII

INCIDENCE OF RESPIRATORY CANCER, 1937 AND 1947
MORBIDITY RATES FOR NINE METROPOLITAN CENTERS, BY SEX
PER 100,000 POPULATION*

Primary Site and City	Males			Females			Total		
	1937	1947	Per cent Increase	1937	1947	Per cent Increase	1937	1947	Per cent Increase
Bronchus and Lung									
Atlanta	5.0	13.4	168	1.0	5.0	400	2.9	8.9	207
New Orleans	13.1	39.1	198	2.8	4.2	50	7.6	20.8	174
Dallas	5.9	29.0	392	0.5	6.4	1180	3.1	17.2	455
Birmingham	4.5	18.9	320	2.1	3.9	86	3.3	11.0	233
Denver	9.1	21.9	141	4.2	8.1	93	6.6	14.8	124
San Francisco	15.6	34.3	120	3.9	8.1	108	9.8	20.8	112
Chicago	13.3	29.3	122	4.3	7.0	63	8.8	18.0	105
Pittsburgh	9.7	26.1	169	4.9	5.5	12	7.3	15.6	114
Detroit	12.6	32.0	154	2.3	5.7	148	7.6	19.0	150
Larynx									
Atlanta	1.4	4.0	186	0.3	0.3	.....	0.9	2.0	122
New Orleans	11.3	14.9	32	0.4	1.0	150	5.6	7.6	36
Dallas	3.2	5.3	66	1.5	0.4	73	2.3	2.7	17
Birmingham	1.4	4.0	186	0.0	1.3	.....	0.7	2.6	271
Denver	2.0	4.1	105	0.0	0.0	.....	0.9	2.0	122
San Francisco	4.5	8.8	96	0.2	0.8	300	2.4	4.6	92
Chicago	6.7	7.0	4	0.4	0.6	50	3.5	3.7	6
Pittsburgh	4.4	8.0	82	0.4	0.8	100	2.4	4.4	83
Detroit	3.5	6.4	83	0.4	0.3	—25	2.0	3.4	70

*Biometrics Section, National Cancer Institute.

INCREASE IN PRODUCTION OF CANCER-RELATED CHEMICALS IN THE UNITED STATES

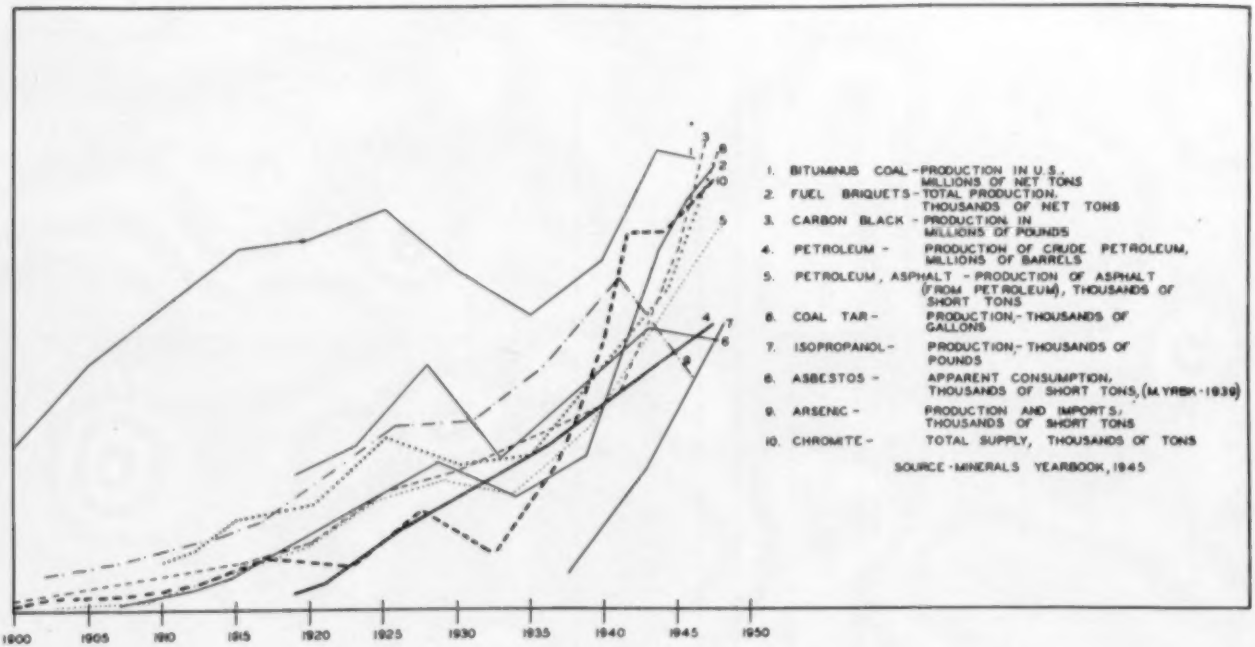
1. BITUMINUS COAL - PRODUCTION IN U.S., MILLIONS OF NET TONS
2. FUEL BRIQUETS - TOTAL PRODUCTION, THOUSANDS OF NET TONS
3. CARBON BLACK - PRODUCTION IN MILLIONS OF POUNDS
4. PETROLEUM - PRODUCTION OF CRUDE PETROLEUM, MILLIONS OF BARRELS
5. PETROLEUM, ASPHALT - PRODUCTION OF ASPHALT (FROM PETROLEUM), THOUSANDS OF SHORT TONS
6. COAL TAR - PRODUCTION, - THOUSANDS OF GALLONS
7. ISOPROPANOL - PRODUCTION, - THOUSANDS OF POUNDS
8. ASBESTOS - APPARENT CONSUMPTION, THOUSANDS OF SHORT TONS, (M.YRBK - 1939)
9. ARSENIC - PRODUCTION AND IMPORTS, THOUSANDS OF SHORT TONS
10. CHROMITE - TOTAL SUPPLY, THOUSANDS OF TONS
SOURCE - MINERALS YEARBOOK, 1945
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950

FIGURE 5

TABLE XIX

AROMATIC HYDROCARBON ESTIMATED IN ONE-MINUTE SAMPLES OF DIESEL EXHAUST WITH VARYING LOAD AND ENGINE REVOLUTION SPEED WITH FUEL INJECTION INEFFICIENCY

(P. KOTIN)

			Quantities Expressed in Ugm./Minute				
RPM	Lead	Condition	Pyrene	CPD. X	Benz-Pyrene	Benz-Perylene	Anth-anthrene
1000	0	Compression Release	137	22	146	22	0
	1/4	Compression Release	267	76	465	42	43
	1/2	Compression Release	536	175	772	124	223
	3/4	Compression Release	1800	640	1320	610	472
	4/4	Compression Release	2500	639	876	1265	469
1200	0	Compression Release	208	0	9	79	4.3
	1/4	Compression Release	257	0	47	40	24
	1/2	Compression Release	448	278	437	171	197
	3/4	Compression Release	888	488	432	930	320
	4/4	Compression Release	1912	614	1706	976	944
1400	0	Compression Release	188	0	80	0	20
	1/4	Compression Release	177	56	78	0	16
	1/2	Compression Release	220	76	1372	368	69
	3/4	Compression Release	734	337	892	1071	577
	4/4	Compression Release	822	346	1687	944	666

blacks, tar fumes and dust, pitch and asphalt dust and fumes, lubricating and cutting oil mists and fogs, engine exhausts); over 2,000,000 with contact to metal fumes, vapors and dusts; and many thousands of others inhaling for occupational reasons other occupational carcinogens, such as arsenicals, asbestos and radioactive materials.

6. Since some of the recognized occupational respiratory agents have been found among the local and/or general air pollutants particularly of urban and industrialized areas, people living and working in such regions sustain beyond any doubt an attenuated form of exposure to these carcinogens. While inhalation contact with chromium compounds (chromite ore, chromates, chrome pigments), beryllium compounds, arsenicals and asbestos is usually of local character and depends upon the release of specific effluents by certain industrial plants or the use of certain chemicals for special purposes (pesticides, antirusting agents), respiratory exposure to other carcinogens air pollutants, such as polycyclic hydrocarbons contained in soot, exhaust fumes of gasoline and diesel engines and fumes from industrial furnaces, oxidized unsaturated aliphatic hydocarbons from evaporated or non-combusted gasoline acted upon by atmospheric oxidants, and radioactive matter, is of more or less generalized nature.

Although the atmospheric concentrations of carcinogens encountered under these conditions are considerably below those prevailing with occu-

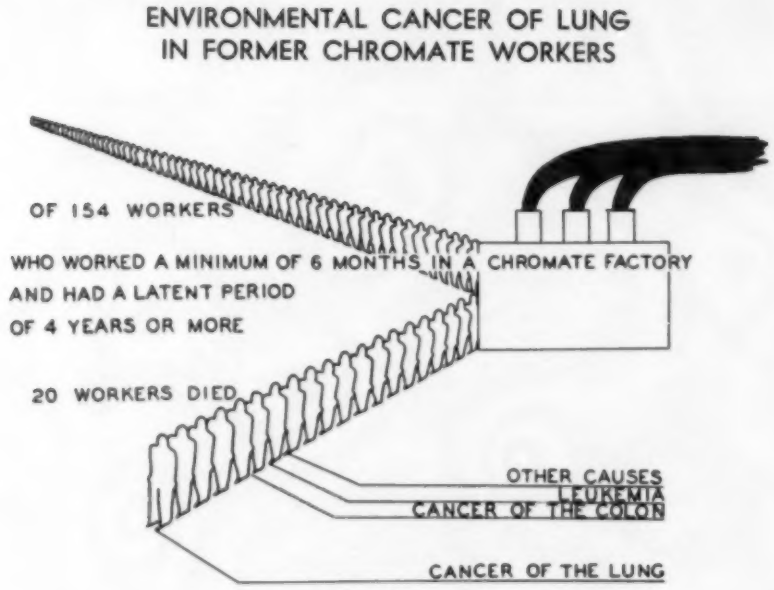
ENVIRONMENTAL CANCER OF LUNG
IN FORMER CHROMATE WORKERS
OF 154 WORKERS
WHO WORKED A MINIMUM OF 6 MONTHS IN A CHROMATE FACTORY
AND HAD A LATENT PERIOD
OF 4 YEARS OR MORE
20 WORKERS DIED
OTHER CAUSES
LEUKEMIA
CANCER OF THE COLON
CANCER OF THE LUNG

TABLE V

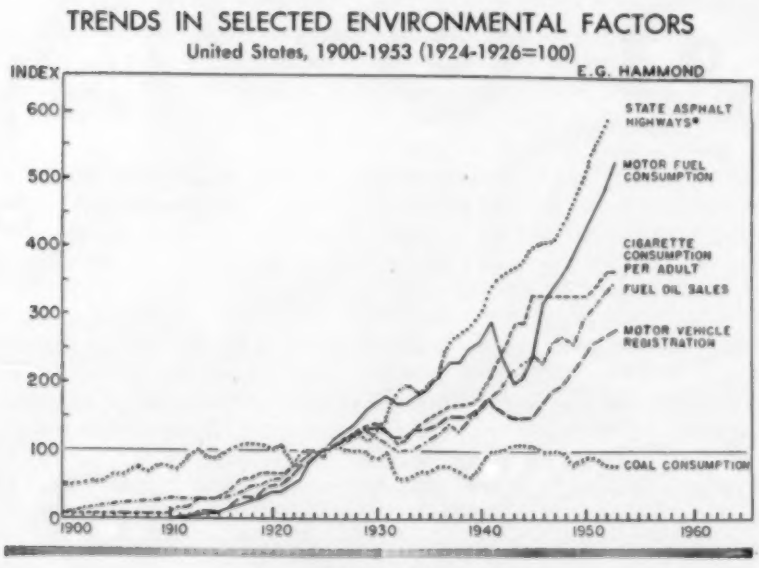

FIGURE 5A

TABLE XX

AROMATIC HYDROCARBONS ESTIMATED IN ONE-MINUTE SAMPLES OF GASOLINE EXHAUST WITH VARYING ENGINE REVOLUTION SPEEDS (P. KOTIN)

RPM	Quantities Expressed in Ugm. at 0 Lead				
	Pyrene	CPD. X	Benzpyrene	Benzperlene	Anthanthrene
500	225	289	120	235	153
1000	439	325	61	177	102
1500	507	266	33	60	36
2000	374	142	40	73	27
2500	346	127	25	70	31
3000	121	25	13	85	14
3500	48	5	10	39	15

pational exposures, numerous epidemiologic observations on the geographical distribution of lung cancer suggest that they are nevertheless carcinogenically effective.

In fact, the first observations on an appreciable rise in the frequency of lung cancer were reported from the highly industrialized cities of densely populated Saxony during the first two decades of this century. Some years later it was found that high lung cancer rates existed for the population of the industrialized territory of the Ruhr valley, while they were below average for the agricultural region of the Main valley.

A similarly irregular distribution pattern of lung cancer frequency rates was recently established for urban-industrialized and rural regions of Austria, England and the United States (Table XIII, XIV, XV, XVI; Fig. 2, Fig. 3). There is moreover evidence from England and the United States showing that in general the lung cancer death rates increase with the size of the community and the population density (Table XVII) and therefore display a certain amount of parallelism between these two factors and the presumptive degree of air pollution. However, definite exceptions to this rule have also been noted indicating that the quality of air pollutants may play a role and/or that additional, still unknown environmental factors may be active in controlling lung cancer attack rates, on a local level (Table XVIII). It is finally noteworthy that this urban-rural distribution pattern of lung cancer death rates conforms with the increased exposure of urban populations to known environmental industry-related carcinogens and their progressively increased use and production particularly in urban areas (Tables XIX, XX; Figs. 4, 5, 5A).

CONCLUSIONS

1. The evidence presented definitely establishes the fact that some well defined exogenous physical and chemical agents are causally involved in the production of occupational cancers of the respiratory system of members of certain restricted worker groups.

2. Since epidemiologic studies of various large worker groups and of the

membership of special occupations have shown marked differences in their lung cancer death rates and in view of the fact that excessive lung cancer death rates have been found in occupational groups with occupational exposure to known industrial respiratory carcinogens, it is likely that industry-related factors account for a much larger number of lung cancers than that on record.

3. The demonstration of recognized environmental respiratory carcinogens in the atmosphere especially of urban areas and of consistently and markedly higher lung cancer death rates for urban populations over rural populations strongly suggests that industry-related air pollutants may play a causal role in the causation of lung cancer and its recent considerable increase in frequency in practically all industrialized countries.

4. While occupational and industry-related carcinogenic air pollutants seem to play an important role in the causation of lung cancer and its recent increase in frequency, it is obvious that they are not the only factors responsible for pulmonary carcinogenesis.

5. Research on the etiology of lung cancer therefore should be conducted on a broad basis, including not only inhalants but also agents entering the body through non-respiratory routes.

RESUMEN

1. La evidencia que se presenta definidamente asienta el hecho de que algunos agentes exogenos, físicos y químicos determinados, influyen causalmente en la producción de cánceres ocupacionales del aparato respiratorio en ciertos grupos limitados de trabajadores.

2. Puesto que los estudios epidemiológicos de varios grandes grupos de trabajadores han mostrado notables diferencias en la frecuencia de las muertes por cáncer del pulmón, en vista de que se han encontrado excesivas proporciones de muertes por cáncer del pulmón en grupos de trabajadores que debido a sus ocupaciones sufren exposición a substancias carcinogénicas respiratorias industriales, es posible que los factores en relación con la industria tengan mucho mayor número de cánceres en su haber de lo que se concede.

3. La demostración de la existencia de carcinógenos respiratorios en la atmósfera especialmente de áreas urbanas con mucho mayor proporción de muertes por cáncer que en las áreas rurales, fuertemente sugiere que hay polución de aire por las industrias que pue de desempeñar un papel causal en el cáncer del pulmón y su aumento reciente en práticamente todos los países industrializados.

4. Si bien los agentes carcinogénicos que polucionan el aire en los ambientes industriales profesionales parecen desempeñar un papel importante en la génesis del cáncer y en su reciente aumento de frecuencia, es obvio que no son los responsables únicos de la carcinogénesis pulmonar.

5. La investigación sobre la etiología del cáncer del pulmón por tanto debe conducirse sobre una base amplia que incluya no sólo los agentes inhalados sino también aquéllos que ingresan en el organismo por otras vías además de las respiratorias.

SCHLUSSFOLGERUNGEN

1. Die vorgebrachten Belege stellen abschliessend die Tatsache ausser Frage, dass einige klar abgegrenzte exogene physikalische und chemische Kräfte ursächlich beteiligt sind bei der Entstehung des Berufskrebses des Respirationstraktes von Angehörigen bestimmter beschränkter Berufsgruppen.

2. Nachdem epidemiologische Untersuchungen von verschiedengrossen Berufsgruppen und von Angehörigen spezieller Berufe ausgesprochene Differenzen ergeben haben hinsichtlich ihrer Sterblichkeitsziffer an Lungenkrebs, und im Hinblick auf die Tatsache, dass übermässige Sterblichkeitsziffern an Lungenkrebs bei Berufsgruppen gefunden wurden mit beruflicher Exposition auf bekannte industrielle carcinogene Stoffe der Atmungsorgane, ist es wahrscheinlich, dass auf die Industrie zu beziehende Faktoren für eine viel grössere Zahl von Lungenkrebsen verantwortlich sind als die überliefert ist.

3. Der Nachweis von anerkannten, durch die Umgebung bedingten carcinogenen Stoffen des Respirationstraktes in der Atmosphäre besonders in städtischen Bereichen und von gleichmässig und ausgesprochen höheren Sterblichkeitsziffern an Lungenkrebs unter der städtischen Bevölkerung gegenüber der ländlichen Bevölkerung legt die Vermutung nahe, dass die im Zusammenhang mit der Industrie stehenden Luftverunreinigungen eine ursächliche Rolle spielen könnten für das Zustandekommen des Lungenkrebses und seine kürzliche beträchtliche Häufigkeitszunahme in praktisch allen industrialisierten Ländern.

4. Während berufsbedingte und auf die Industrie bezügliche carcinogene Luftverunreinigungen eine bedeutende Rolle zu spielen scheinen für das Zustandekommen des Lungenkrebses und seine jüngste Häufigkeitszunahme, liegt es auf der Hand, dass dies nicht die einzigen, für das Zustandekommen von Lungenkrebs verantwortlichen Faktoren sind.

5. Forschungen über die Aetiologie des Lungenkrebses müssen daher auf breiter Basis ausgeführt werden und nicht nur inhalierbare Stoffe einschliessen, sondern auch solche Bestandteile, die in den Körper auf anderem Wege als über die Atmung eindringen.

Primary Chylopericardium and its Surgical Treatment

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Surgically treated massive chylopericardium is a rare condition.

A study of the world literature up to 1954 did not show a single case of isolated massive chylopericardium comparable to the case reported in this paper. Several writers have reported the presence of small quantities of chylous milky fluid in the pericardial sac found at operation or at autopsy of patients suffering from chylothorax or chyloperitoneum, but there is no observation of massive isolated chylopericardium. After the preparation of this manuscript and well after the operation of our patient we have become aware of the case published in March 1954 by Groves and Effler.[1] Their patient suffered also from isolated massive chylopericardium etiologically related to cystic lymphangioma of the right upper mediastinum. Hasebrock[2] reported in 1888 a case in which at autopsy he found a few drops of milky chylous fluid in the pericardium. There was no such fluid in the pleural or peritoneal cavity. Meade[3] reported the case of a 58 year old woman who died from mediastinal lymphosarcoma and who at autopsy was found to have bilateral chylothorax and small chylopericardium. Scannell[4] reported also a case of right chylothorax associated with an unimportant chylopericardium. In spite of two successive operations for ligation and resection of the thoracic duct this patient died from chylothorax.

Our case of chylopericardium was an *isolated* one not associated with any chylous effusion in the pleural or peritoneal cavities. Furthermore it was a massive effusion endangering the life of the patient by *cardiac tamponade*. She has been successfully treated by *ligation of the thoracic duct* just as has been done in the case of Groves and Effler but in opposition to their case there was no mediastinal tumor to be found at operation.

This girl was born April 5, 1952. In January 1953, she presented an episode of what was apparently a respiratory infection, with cough and dyspnea. At the age of one year she fell down stairs. She was unconscious for a few minutes. There seems to have been hemoptysis and nose bleeding and for two days she seems to have vomited several times. One month later she again suffered from cough and dyspnea and was admitted to a hospital. At fluoroscopy on May 22, a competent radiologist notes bronchopneumonia at both bases but no abnormality of the heart shadow. On June 4, another doctor found a considerably enlarged heart shadow and made the diagnosis of pericarditis. Thereafter pericardial effusion had to be tapped every 10 days and each time from 60 to 230 cc. of milky fluid were aspirated. The effusion reformed rapidly after every aspiration and caused the alarming symptomatology of progressive cardiac tamponade. On August 14, 1953, she was referred to us and admitted to the Hospice de l'Enfance for surgical treatment. The chest x-ray film showed marked enlargement of the heart shadow (Figs. 1 and 2). Pulse rate was at 130/min. and the ECG revealed the typical signs of pericarditis. Tuberculin reactions as well as Wassermann test were negative. There were no abnormal findings in the usual laboratory examinations of blood and urine. The chemical and cellular examination of the pericardial fluid showed that it was typical chylous effusion.

At *operation* on September 3, 1953, a right lateral thoracotomy was made. There was no chyle in the pleural cavity nor was there any evidence of mediastinal tumor.

A longitudinal incision of the pericardium anterior to the phrenic nerve was made and 150 cc. of milky fluid were aspirated. There was marked pericardial thickening and the inner surface of the posterior pericardium was covered with a layer of fibrine. We were unable to find a fistula between the thoracic duct and the pericardium and, just as we expected it before exploration, we had to ligate the lower thoracic duct. This structure was found in its normal position lying in the right lower mediastinum between esophagus and aorta. All the surrounding tissue including the azygos vein was also ligated to prevent chyle from reaching the pericardium by way of a collateral channel.

The postoperative course was uneventful. No chyle appeared in the pleural drain and there was no recurrence of the chylopericardium. Today, two years later, she is doing fine but there is and has been since operation a persisting enlargement of the cardiac shadow which is due in our opinion to marked pericardial thickening (Fig. 3).

Diagnosis

Once the diagnosis of pericardial effusion has been made it is generally easy to determine the chylous nature of the aspirated fluid. The fluid is milky in appearance. It is alkaline and the specific weight varies between 1010 and 1021. The fluid contains characteristic lipoid substances and its content in electrolytes, proteins, glucose and cholesterol corresponds to that of the blood serum but may depend on the food that has been absorbed. Chemical analysis of the fluid in our case showed the following composition: Glucose 82 mg. per cent, total cholesterol 118 mg. per cent, free cholesterol 27 mg. per cent, free chol. in per cent of the total chol. 25 per cent; total proteins 4,2 g. per cent; total lipids 0,8 per cent. Albumin 53,3 per cent; α_1 globulin 5,8 per cent; α_2 globulin 7,8 per cent; β_1 globulin 12,2 per cent; β_2 globulin 2,3 per cent; δ globulin 18,6 per cent.

Meade observed a considerable diminution of lymphocytes and eosinophils in the blood following rupture or ligation of the thoracic duct. In our case the blood count was the following:

Before Operation	
Hemoglobin	85 Per Cent
Red corpuscles	5.140.000
Color index	0,83
Leukocytes	6.960
Neutr. stab.	8,5
Segmented neutrophils	46
Eosinophils	3
Basophils	0,5
Monocytes	8
Lymphocytes	34
After Operation	
Hemoglobin	72 Per Cent
Red corpuscles	5.230.000
Color index	0,70
Leukocytes	6.880
Neutr. stab.	10
Segmented neutrophils	43
Eosinophils	8,5
Basophils	----
Monocytes	8
Lymphocytes	30
Myelocytes	0,5

Etiology

The etiology of chylopericardium should be more or less the same as the one of chylothorax, i.e., *traumatic rupture* of the thoracic duct or its *erosion by a neoplastic or inflammatory process.* In our case a definite etiological factor can not be determined as the history reveals a trauma as well as an inflammatory broncho-pulmonary episode. It may be possible that this inflammatory condition gave rise to a severe lymph-node reaction which might have erroded the thoracic duct and the pericardium. However, we have to concede that there is no definite proof for one or the other.

*Anatomy**

From the anatomical stand point the etiology is extremely difficult to explain as normal anatomy knows of no relation whatsoever between the pericardium and the thoracic duct. The latter is a fine structure originating in the subdiaphragmatic cisterna chyli coming through the diaphragm at the aortic hiatus, lying then on the anterior surface of the vertebral column and coming up the mediastinum between the azygos vein at the right, the aorta at the left and the esophagus in front. It crosses the superior mediastinum behind the great vessels of the base of the heart going over to the left and into the left subclavian vein. Normally a close

*We wish to thank Professor Georges Winckler, Professor of Anatomy at the Lausanne Medical School for his expert advice before and after operation in this case.

FIGURE 1

topographical relationship between the thoracic duct and the pericardium is impossible, as those two structures are everywhere separated by the esophagus situated in front of the thoracic duct.

At operation we were not able to demonstrate the topographic relationship between the pericardium and the thoracic duct but there is no doubt about its reality because the patient had prior to operation a massive chylous pericardial effusion which has been arrested by thoracic duct ligation. Many writers (Stuart, Davis, Meade, e.a.) have reviewed the anatomical variations of the thoracic duct. Davis in particular reported 9 variations discovered by dissection of the thoracic duct in 22 cadavers, but none of these showed a duct in close vicinity of the pericardium.

Treatment

Massive chylopericardium gives rise to three different therapeutic problems. First, one has to stop the danger of *acute cardiac tamponade*. Second, one has to prevent secondary constriction of the heart by chronic *constrictive pericarditis*. Third, one has to choose the *best surgical approach*.

Cardiac tamponade certainly calls for immediate measures. As needle aspiration gave only temporary relief surgical closure of the chylopericardial fistula was indicated and, if that was impossible, ligation of the thoracic duct had to be done. In fact numerous authors have demonstrated the fact that thoracic duct ligation is well tolerated by laboratory animals (Lee, Co Tui e.a., Blalock e.a.). Besides a number of surgeons have successfully done this operation in man and no unfavorable effect has been observed (Cushing, Harrison, Lee, Crandall, Lampson, Meade, Vandooren, Braillon). *Lee* has demonstrated the presence of collateral lymphatic vessels that may take over after ligation of the main duct.

One should furthermore have in mind the prevention of secondary *constriction of the heart* by thickened pericardial envelope. Meade has already drawn attention to the fact that the chylous fluid caused local irritation of the pleura and that therefore in certain cases of long-standing chylothorax *pleural decortication* may become necessary. The same local irritation may also lead to similar *pericardial thickening*. In fact we have found at operation a layer of fibrin on the inner surface of the pericardium and postoperative x-ray films show a still considerable enlargement of the heart-shadow due to pericardial thickening (Fig. 3). Nevertheless there is clinically no sign of *constrictive pericarditis*. We are some what doubtful about the long term postoperative course and are somewhat afraid that ultimately *cardiac decortication* may become necessary. It seems therefore that in any future case of chylopericardium that may come under observation its speedy surgical treatment is imperative if dangerous pericardial thickening is to be prevented.

The *surgical approach* of chylopericardium is an important problem that should be thoroughly studied.

We have for some time before this operation hesitated between left and right thoracotomy. It would seem that left thoracotomy would be the ideal

FIGURE 3

FIGURE 2

way for thorough exploration of the pericardial sac and for the discovery and obliteration of a chylopericardial communication. The hazard of failure of such an exploration was, however, great, particularly in the case of a young child with the surgeon necessarily working in a narrow field. In case of failure to discover the fistula the main thoracic duct would have to be ligated in the lower mediastinum. The duct lying on the right side of the lower mediastinum, its dissection through a left thoracotomy would be difficult. We therefore choose the right transpleural approach and after unsuccessful pericardial exploration were able to ligate the thoracic duct without any difficulties. In conclusion there seems to be no hesitation about the fact that chylopericardium should be approached by a *right thoracotomy*.

SUMMARY AND CONCLUSIONS

1. A case of chylopericardium successfully treated by ligation of the thoracic duct has been reported. Up to 1954 no other case has been reported in the world literature.

2. The *diagnosis* is easy to establish by chemical examination of the milky fluid aspirated from the pericardium. The *etiology* is doubtful because in this case the history reveals a definite trauma as well as an inflammatory bronchopulmonary episode. There was no mediastinal tumor as in the somewhat different case reported by Groves-Effler in 1954.

3. A study of normal topographic *anatomy* does not explain this case as normally the thoracic duct and the pericardium are everywhere separated by the esophagus. One has to admit an anatomical variation several of which have already been reported in the literature.

4. The *treatment* of chylopericardium is *surgical exploration* of the situation. It will always be extremely difficult to demonstrate and obliterate the abnormal communication and therefore one has to be satisfied with *ligation of the thoracic duct* to prevent cardiac tamponade. Local irritation of the pericardium by the chylous fluid may lead to *chronic pericardial constriction* and thus necessitate ultimate *cardiac decortication*. To prevent this future complication the surgical treatment of chylopericardium at the acute state has to be an early one.

RESUMEN

1. Se relata un caso de quilopericardio tratado con éxito por medio de la ligadura de conducto torácico. Hasta 1954 no se había publicado otro caso en la literatura médica.

2. El diagnóstico es fácil por el examen del líquido le choso que se aspira del pericardio. La etiología es dudosa por que en este caso la historia clínica incluye tanto un traumatis mo como un episodio inflamatorio broncopulmonar. No había tumor del mediastino como en el caso algo diferente relatado por Groves-Effler en 1954.

3. El estudio de la anatomía topográfica normal no explica este caso ya que normalmente el conducto torácico y el pericardio están donde quiera separados por el esófago. Se tiene que admitir una variación anatómica, varias de las cuales se han referido ya en la literatura.

4. El tratamiento de quilopericardio es la exploración quirúrgica. Siempre será extremadamente difícil demostrar y ocluir la comunicación anormal y por tanto hay que conformarse con la ligadura del conducto para evitar el taponamiento cardiaco. La irritación local del pericardio por el líquido quilosopuede conducir a la constricción crónica pericárdica y necesitar más tarde la decorticación cardiaca. Para evitar estar futura complicación el tratamiento quirúrgico del quilopericardiotiene que hacer pronto.

RESUME

1. Un cas de *chylopéricarde* traité avec succès par ligature du canal thoracique est rapporté. Il s'agit du premier cas de ce genre rapporté dans la littérature. *Le diagnostic* est facile à établir par l'examen chimique du liquide laiteux, obtenu par ponction péricardique.

2. L'étiologie reste obscure, car l'anamnèse de ce cas révèle d'une part, un traumatisme important et, d'autre part, un épisode inflammatoire, que tous deux ont précédé l'apparition du chylopéricarde de quelques semaines. Nous n'avons pas découvert une tumeur médiastinale lymphangiomateuse telle que celle découverte par Groves et Effler dans leur cas.

3. L'anatomie topographique normale du canal thoracique ne permet pas d'expliquer la présence d'une communication chylo-péricardique, car le canal thoracique devrait normalement être séparé du péricarde sur toute sa longuer par l'oesophage interposé. Des variations de l'anatomie normale du canal thoracique ont cependant été décrites dans la littérature et l'on doit forcément admettre l'existence d'une telle variante dans notre cas.

4. Das le *traitement* du chylopéricarde il sera probablement toujours difficile de mettre en évidence la communication chylo-péricardique et de l'oblitérer. On doit, faute de mieux, avoir recours à *la ligature du canal thoracique* en dessous de la communication, afin de parer aux accidents répétés de *compression cardiaque* aiguë. L'effet local du chyle sur les séreuses (plèvre, péricarde, etc.) entraîne le danger d'une *constriction péricardique chronique* qui peut secondairement entraîner la nécessité d'une *décortication cardiaque* ultérieure. Afin d'éviter cette complication lointaine, le traitement du chylopéricarde en stade aigu doit être précoce.

ZUSAMMENFASSUNG

1. Es wird über einen Fall von Chylopericard berichtet mit erfolgreicher Behandlung durch Ligatur des ductus thoracicus. Bis zum Jahre 1954 ist über keinen anderen Fall in der Weltliteratur berichtet worden.

2. Die Diagnose ist leicht zu stellen durch chemische Untersuchung der aus dem Pericard aspirierten milchigen Flüssigkeit. Die Aetiologie ist zweifelhaft, weil in diesem Fall die Vorgeschichte ebenso ein bestimmtes Trauma aufdeckt wie ein entzündliches bronchopulmonales Geschehen. Es lag kein Mediastinal-Tumor vor, wie in dem etwas abweichenden Fall, der von Groves-Effler im Jahre 1954 mitgeteilt worden ist.

3. Eine Betrachtung der normalen topographischen Anatomie erklärt diesen Fall nicht, da normalerweise der ductus thoracicus und das Pericard überall durch den Ösophagus getrennt sind. Man muss eine anatomische

Variation zugestehen, wie sie schon verschiedentlich in der Literatur mitgeteilt worden ist.

4. Die Behandlung des Chylopericards besteht in einer chirurgischen Klärung der Situation. Es wird immer äusserst schwierig sein, die abnorme Verhindung nachzuweisen und zu veröden und man wird sich deher zufrieden geben müssen mit der Ligatur des ductus thoracicus, um eine Herzbeuteltamponade zu verhindern.

Eine lokale Reizung des Pericards durch die Chylusflüssigkeit kann zu einer chronischen pericardialen Einengung führen und dadurch eine spätere cardiale Dekordikation notwendig machen. Um diese zukünftige Komplikation zu verhindern, muss die chirurgische Behandlung des Chylopericards im akuten Stadium eine frühzeitige sein.

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Intermittent Positive Pressure Breathing

*An Adjunct in the Rehabilitation of Thoracic Surgery Patients**

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In the past decade, important consideration has been given to the rehabilitation of post-operative thoracic surgery patients. Particularly in those institutions where large volumes of thoracic surgery have been done, the need for early restoration of shoulder function and chest motion has become obvious.

As early as 1934, Miss Winifred Linton at the Brompton Hospital[1] in London, instituted, under Mr. J. E. H. Roberts, a pioneer rehabilitation program in the field of non-tuberculous chest surgery. In 1938, Mr. Tudor Edwards initiated a program of controlled breathing and shoulder exercises for post-thoracoplasty patients, with special emphasis directed toward posture correction. It was largely through his interest that this type of treatment was brought to the attention of American physicians on duty in England during World War II. Since that time, similar rehabilitation programs have been adopted in this country, particularly in Army[2, 3, 4, 5] and Veterans' Administration[6, 7, 8] chest centers.

At Valley Forge Army Hospital, an extensive program of resectional surgery has been carried out in the past few years for tuberculous and non-tuberculous pulmonary problems. Each patient is seen by the Physical Medicine Service prior to surgery and is instructed in the exercises that will be expected of him post-operatively. These include localized pressure expansion and diaphragmatic breathing, a variety of the usual shoulder girdle motions, and postural correction. After surgery, beginning with the first post-operative day, active treatment is given until a satisfactory result is obtained, usually in two to three weeks.

One of the most perplexing problems in this treatment has been the fact that underwater seal drainage tubes and the operative incision cause discomfort and spasm to such a degree that the patient is often reluctant to use the operated side of the chest. We have been intrigued by the possibilities of the newly developed intermittent positive pressure breathing (IPPB) machines which cycle with the patient's breathing and which deliver any amount of inspiratory pressure desirable up to 40 centimeters of water. We have felt that this instrument might be of value in overcoming the

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This material has been reviewed and there is no objection to publication by the Office of The Surgeon General, Department of the Army.

mental barrier to ventilation induced by post-operative pain. To this end, we have set up the following preliminary study.

Thirty routine patients undergoing resectional pulmonary surgery were employed in the study. They were operated upon for the following conditions:

Pulmonary Tuberculosis	27
Bronchogenic Cyst	1
Hamartoma	1
Blastomycosis	1

The operations performed were as follows:

Lobectomy	1
Segmental resection	14
Segmental and wedge resection	12
Wedge resection	3

The average age was 31 years with extremes of 19 and 49 years. There were seven females and 23 males. There was no severely debilitated individual in the group and no serious or major post-operative complications were encountered.

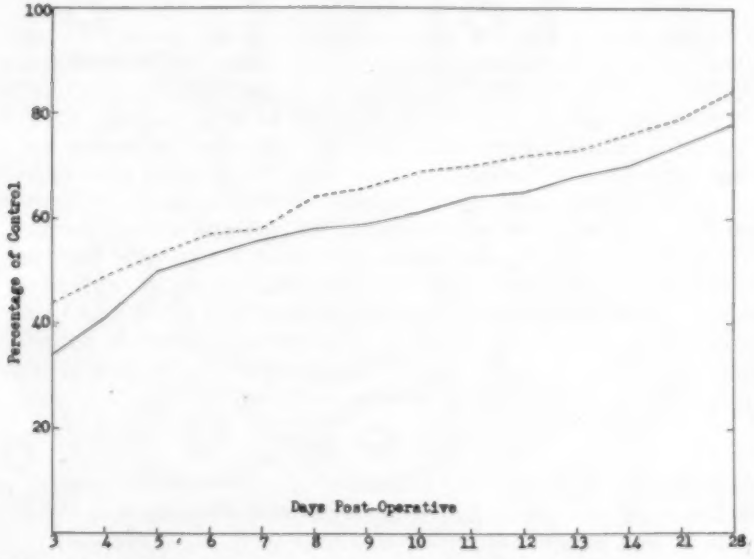

FIGURE 1: Dotted line indicates curve of patients receiving IPPB and exercise. Unbroken line indicates curve of patients receiving exercise alone.

The first 15 patients were treated with shoulder exercises and postural correction once a day and with pressure-expansion breathing exercises five minutes each treatment, four times a day, for the first two post-operative weeks. The second group received the same exercise regime, but in addition were given IPPB* at 5 to 20 centimeters of water concomitantly with pressure-expansion breathing, five minutes each treatment, four times a day, for the same post-operative period. While 20 minutes is the generally accepted length of IPPB treatment, is was felt that in view of the tiring effect of the respiratory effort and the post-operative status, a shorter period would be more suitable. After the first two weeks, breathing, shoulder and postural exercises were performed by all patients on their own, twice daily.

On the day before surgery, daily from the third to the 14th post-operative day, and again on the 21st and 28th days, total vital capacities were recorded on a Collins Timed Vitalometer.

Results

Taking the pre-operative value as the control, or 100 per cent, the patient's daily post-operative vital capacity was computed as a percentage of the control. In each group of patients, the percentages of each post-operative day were totalled, divided by the number of patients in the group, and charted in figure 1. This graph shows a progressive, more rapid approach to the pre-operative value for the group of patients treated with IPPB in addition to exercise.

Discussion

This has been a fairly uniform group of young patients undergoing similar types of operations without serious operative or post-operative complications. Graphic results indicate firmly that patients receiving IPPB with exercises made a more rapid recovery of vital capacity than those with exercise alone. Observation from patient to patient leaves one with the impression that actual chest motion is recovered much more quickly in those receiving intermittent positive pressure breathing. To be sure, variation from patient to patient as far as his attitude toward surgery, his response to pain, and his medication can cloud the picture; however, we feel that the graphic results of observed vital capacities, as well as the objective visual improvement, strongly suggest that IPPB may be an important aid in the rehabilitation of post-operative thoracic surgery patients. In no case was IPPB found to be intolerable to the patient or prone to potentiate leaks following segmental resection.

CONCLUSION

A study has been presented indicating that intermittent positive pressure breathing treatments in the post-operative thoracic surgery patient appear to be a helpful adjunct in obtaining more rapid recovery.

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*V. Ray Bennett Intermittent Positive Pressure Breathing apparatus used.

CONCLUSION

Se ha presentado un estudio indicando que los tratamientos por inhalación a presión positiva intermitente en el paciente en post-operatorio de cirugía torácica parecen ser un coadyuvante útil para la recuperación más rápida.

RESUME

Les auteurs présentent une étude montrant que les traitements par respiration sous pression positive intermittente dans la chirurgie thoracique post-opératoire semblent être un adjuvant efficace à l'obtention d'une guérison plus rapide.

SCHLUSSFOLGERUNG

In einer Arbeit wurde gezeigt, dass die postoperative intermittierende Überdruckbehandlung bei Lungenoperierten eine wertvolle Hilfe zur schnellen Wiederherstellung zu bedeuten scheint.

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Diagnosis and Treatment of the More Common Congenital Cardiovascular Anomalies*

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Malformations of the heart are the result of an arrest or defective development at some specific point. These developmental errors may be due to defective genes or to abnormalities in the environment. German measles during early pregnancy is associated with a high incidence of congenital cataracts and congenital heart anomalies. Since malformations of the heart result from localized arrest in development, the remainder of the heart progresses as nearly as possible in the normal manner. It follows in most instances the malformed heart occupies the normal position. This renders it possible to analyze which chambers are enlarged and which are absent. By this means it is often possible to make a relatively accurate clinical diagnosis as to the nature of the abnormality.

Before 20 years ago the vast subject of congenital cardiovascular anomalies was of academic interest mainly to the pathologist. Dr. Maude Abbott made a lifetime autopsy study of 1,000 cases with which she correlated clinical symptoms and signs presented by the various malformations. She emphasized the importance of a communication between the systemic and venous circuits. This communication usually presents itself as a patent ductus arteriosus, atrial septal defect, or ventricular septal defect. Because of the greater pressure in the left heart than in the right, blood is shunted from arterial to venous side in pure form of the above abnormalities. Since, in these instances, oxygenated blood is shunted through the lungs again, there is no cyanosis. If some complicating condition causes increased pulmonary pressure, blood may be shunted from right to left through a patent ductus or a septal defect. If the amount of blood shunted is such that at least 5 Gm. of reduced hemoglobin per 1,000 cc. of circulating blood is present, cyanosis will be present. In anomalies with no intercircuit communication cyanosis is absent. It is also not present in the absence of congestive heart failure.

In 1939 great practical interest turned toward congenital heart abnormalities because Gross successfully ligated a patent ductus arteriosus. In 1944 Blalock and Taussig developed a systemic pulmonic anastomosis for cyanotic conditions in which the primary difficulty is lack of adequate circulation to the lungs, and relative pressure of the two circulations is such that blood will flow through the new artificial duct. In 1945 Crafoord performed a direct resection for coarctation of the aorta. Potts in 1946 developed a modification of the Blalock procedure. This operation consists of a side anastomosis of the pulmonary artery and aorta. It is advantageous in that it is technically a much simpler procedure. In small infants the

*Second prize, 1955 College Essay Contest.

subclavian artery used in a Blalock may be too short, friable, and/or narrow in caliber for good results. By use of the Potts procedure the exact size of the shunt is known. Morbidity is much lower with employment of the Potts operation. Its main disadvantage is that at present, one cannot determine accurately the size of the shunt to make. There is much difference of opinion concerning this procedure. In 1948 Brock described valvulotomy for pulmonary stenosis.

Because of these vast surgical advances, interest now must be turned to accurate diagnosis in order to select patients who can hope to benefit from the various procedures. A good, thorough history and physical examination enables an acute physician to make a diagnosis in most instances.

Electrocardiography: Many children with congenital heart disease show normal electrocardiograms; however, characteristic patterns are frequently produced as a result of specific changes in size, shape and position of the heart chambers. The configuration of the ECG depends on the type of anomaly present, or, if more than one, the predominant one since this determines the part of the heart most changed. Ventricular hypertrophy is recognized best in unipolar precordial leads. Electrocardiographic findings must be correlated with clinical data to be of specific value.

Angiocardiography: This is a good means of studying the anatomy of the living heart. It is of great value from the surgical standpoint in delineating the anatomical arrangement of the arterial branches of the aorta and the position of the pulmonary artery. This is not an entirely innocuous procedure since death has been reported in about 0.3 per cent of cases. It is indicated in general diagnosis, especially in the presence of a poor pulmonary blood supply with the possibility of a Blalock operation in mind. Contraindications include liver and kidney disease, tuberculosis, hyperthyroidism, allergic history, and sometimes congestive failure. Before carrying out this procedure, one must have a working diagnosis in mind, for it is not required in all congenital heart abnormalities.

Catheterization: In recent years the technique of right heart catheterization has been applied to the diagnosis of congenital anomalies of the heart and great vessels. The technique of right heart catheterization allows a means of sampling mixed venous blood in the right heart and pulmonary artery. Abnormal connections between these structures and the pulmonary vein, left atrium, left ventricle, or aorta result in contamination of mixed venous blood with oxygenated blood, since pressure conditions favor shunting of blood from left to right cavities. Therefore, the approximate location of the shunt can be localized, and determined by gas analysis. The shunts can also be located by abnormal routes taken by the tip of the catheter. Contamination of pulmonary venous blood by mixed venous blood can also be recognized by arterial blood analysis. Such contamination occurs when the dynamic conditions prevailing in the heart in the presence of cardiac abnormality favor a shunt from right to left. In addition right heart catheterization and arterial puncture provide a means of recording blood pressures. Since the normal curve patterns and variations are well defined in the various heart chambers and major vessels, recording of blood pres-

sure allows identification of the chamber in which the catheter tip lies and study of the effects of cardiac manifestations upon dynamics of circulation. Most complications are of minor character. If technical acuteness is followed to the utmost, these will be of little consequence. Rhythm disturbance is the most important consideration. Premature beats are manifest on passage of the catheter through the tricuspid valve and in approximation to the septum. Blood loss must be considered and replaced after each step of the procedure in a small infant. Relatively rare complications include air embolism with right to left shunt, and venous thrombosis.

Oximetry: This is a method used in conjunction with catheterization. It allows continuous measurement of oxygen saturation in arterial blood. Demonstration that this saturation decreases rapidly on exercise indicates a right to left shunt. Exercise in a normal person reveals an increase in oxygen uptake as compared to ventilation which reveals a decrease in oxygen content of expired air. If the blood flow through the lungs is limited (pulmonary stenosis, tricuspid stenosis), the oxygen content of expired air may increase during exercise.

Electrokymography and *ballistocardiography,* along with *spatial vectorcardiography,* appear to be promising diagnostic aids and are without hazard. *Dye dilution* techniques also offer vast promise, especially in anomalies with shunts. At present Latson is developing and perfecting a new method of determination of dye dilution by using radioactive iodinated albumin and an external oscillometer over the brachial artery.

There have been numerous methods of classifying congenital cardiovascular disease. Since this paper is concerned only with the more common anomalies, I have chosen a rather simple classification of three main groups: 1) extracardiac, 2) non-cyanotic, and 3) cyanotic.

EXTRACARDIAC ANOMALIES

Patent Ductus Arteriosus

The ductus arteriosus is a normal fetal structure shunting blood from the pulmonary artery into the aorta. At birth, when the lungs begin to function, the ductus normally ceases to function, and at about 10 weeks is completely obliterated. For some unknown reason, it may fail to close and shunt blood from the aorta back to the lungs. It occurs in girls two or three times as often as in boys.

Symptoms: Usually there are no or only minimal symptoms presented. The most common complaint is delay in reaching the developmental milestone. Most are also underweight. Subacute bacterial endocarditis is a frequent finding.

Signs: Probably the most striking murmur in cardiology is that of the patent ductus. It is a continuous machinery murmur heard best in the second left interspace. It is harsh, rasping, and louder in the recumbent position than erect. The systolic component is transmitted to the neck and back, while the diastolic continuation diminishes rapidly. The murmur is

not to-and-fro, for the blood flows *only* in one direction—from the aorta to the pulmonary artery. Therefore, the murmur is entirely systolic but with a continuation into diastole. It is important to remember that in young children it is the rule rather than the exception to hear no extension of the murmur into diastole because of the equality of pressure in the left and right ventricle. The murmur must be differentiated from a truncus arteriosus or pseudotruncus in which the murmur is diffuse due to many minute channels to the pulmonary circulation from the bronchial arteries. Pulmonary arteriovenous fistula is differentiated by presenting a murmur of less intensity, higher pitch, well localized anywhere in the precordium, and usually associated with distal telangiectasis. Other findings include a systolic thrill in the pulmonary area, wide pulse pressure with a low diastolic pressure, and no cyanosis or clubbing.

Diagnostic Tests: X-ray film reveals slight prominence of the pulmonary arc, and dilatation of the pulmonary artery and conus. Fluoroscopy usually shows prominent pulsation in the region of the pulmonary conus. Electrocardiogram is usually normal, as are routine laboratory examinations. In the typical case, angiocardiography and catheterization are not necessary; however, in some instances they are important to confirm diagnosis. In angiocardiography the pulmonary artery remains opaque due to the shunt. Catheterization reveals increase in oxygen in the pulmonary artery, and sometimes an increase in pulmonary pressure.

Treatment: Until the technique of ligation was developed, life expectancy was about 20 years. However, if the patient is asymptomatic and without complications, some authorities postpone surgery. The operation is relatively simple and carries a low mortality.

Coarctation of the Aorta

Two types of coarctation of the aorta have been described: infantile, in which the narrowing extends from the origin of the left subclavian artery to the entrance of the ductus; adult, consists of a local constriction of the aorta at or below the level of the ductus. The infantile type is usually complicated by more serious anomalies and death usually occurs within the first year of life. The adult is seldom complicated by other conditions and, therefore, the discussion will be limited to the latter. This condition occurs six times as often in boys as in girls.

Symptoms: There is no common complaint. Patients appear healthy and there is no cyanosis. There may be numbness of the feet or legs on exercise and difficulty in healing foot wounds.

Signs: There is increased blood pressure in arms and marked decrease in the legs. Femoral pulses are diminished or absent. There is increase in intercostal pulsations. The heart reveals a systolic murmur in the third left interspace and in the interscapular region. It, however, is of little aid in diagnosis.

Diagnostic Tests: X-ray film reveals notching of the lower borders of the ribs. Fluoroscopy shows either a normal heart or left ventricular hypertrophy. Electrocardiogram may be normal, or reveal axis deviation, high

voltage of QRS, depressed RS-T, and inversion of T. There is never right ventricular hypertrophy. Catheterization studies are normal. Angiocardiography reveals the coarctation. However, these adjuncts are not done routinely.

Treatment: Since only 25 per cent of patients with coarctation of the aorta live out a normal life span, surgical resection of the narrowed portion is indicated. Mortality at present is low.

Vascular Rings

There are several variations in position of the arch of the aorta and in the great vessels arising from the aorta. Persistence of both right and left aortic arches encircling the trachea and esophagus and uniting to form the descending aorta is the most important anomaly clinically.

Symptoms: There is no cardiac symptom. The most common complaints are wheezing, stridor, and dysphagia. Sometimes there is cough. There is frequency of pulmonary infections. Of course, there may be no symptom at all.

Signs: Physical examination is essentially negative. Direct bronchoscopy reveals tracheal narrowing.

Diagnostic Tests: X-ray film reveals constriction of the trachea and/or esophagus, usually by the right arch. Electrocardiogram, angiocardiogram, and catheterization are useless.

Treatment: Surgical resection of the smaller branch (usually anterior) is the treatment of choice. This is a serious procedure, mainly due to difficulty in anesthesia, and carries about a 35 per cent mortality.

ACYANOTIC CONGENITAL HEART DISEASE

Atrial Septal Defect

Atrial septal defects are of great importance, since such patients frequently seek medical attention. They are unusually susceptible to pneumonia, rheumatic fever, repeated bronchitis, and are liable to develop various cardiac arrhythmias. Among young adults it is probably the most frequently seen cardiac anomaly and the least frequently diagnosed correctly. This is probably because of the wide variability of auscultatory findings and also because of superimposed rheumatic infection. This abnormality may be seen in four entirely different instances: 1) defective septum primum, 2) defective secundum, 3) patent foramen ovale, and 4) with other abnormalities of the heart.

Symptoms: If the defect is large enough to produce symptoms, one presents with frail build, poor physical development, and repeated bronchitis.

Signs: There usually is a loud, harsh, systolic plateau or decrescendo murmur between the second to fourth left interspace near the sternum. The duration between the aortic and pulmonary valve elements is less than 0.07 seconds. There may be a high frequency, low amplitude diastolic murmur extending to presystole located at the apex. There may be en-

largement of the right heart. The right ventricular hypertrophy may cause left chest deformity. The pulmonary second sound is loud and snapping. There is a systolic thrill in the pulmonary area. The pulse pressure is narrow and the skin appears semitranslucent.

Diagnostic Tests: X-ray film shows great enlargement of the right heart, prominent pulmonary conus, small aortic knob, and increase of the hilar markings. Fluoroscopy frequently shows a hilar dance. Electrocardiogram reveals right ventricular hypertrophy, large and peaked P waves, right bundle branch block, and large equally diphasic QRS complexes which may be seen in all three standard limb leads. Angiocardiography is not diagnostic but shows right atrial dilatation and pulmonary congestion. Catheterization may reveal the defect directly by the tip extending through the defect, and indirectly by an increase in oxygen in the right atrium, and an increase in pulmonary artery pressure.

Treatment: In relatively small defects, closure is unnecessary. In the more serious cases, closure may be attempted. The present consensus of operative technique employs a purse string closure. Mortality is rather high, mainly due to the severity of malformation.

Ventricular Septal Defect

Symptoms: There is no symptom unless the defect is large. In that case one complains of the symptoms of heart failure, and/or bronchitis. There is never cyanosis. Growth is normal. As a pure malformation, this anomaly is probably more common than atrial septal defect.

Signs: The characteristic sign is a harsh plateau systolic murmur and thrill maximal in the third or fourth left interspace near the sternum and radiating in all directions and to the back. There usually is no heart enlargement.

Diagnostic Tests: X-ray film may be normal or reveal an enlarged heart, a bulge in the region of the pulmonary artery and conus, and a small aorta. Fluoroscopy may show pulmonary hypertension. Angiocardiography is not diagnostic, but reveals distention of the pulmonary artery and lung vessels. Electrocardiography reveals either normal tracing or high voltage diphasic QRS in all leads. Catheterization reveals increase in oxygen saturation in the right ventricle (which is higher than that in the right atrium).

Treatment: Prophylaxis against subacute bacterial endocarditis is important. Surgical closure is still in an embryonic stage, but a purse string closure has been successfully attempted.

Pulmonary Stenosis

Pure pulmonary stenosis is not a relatively common congenital heart malformation, but is important in that it must be distinguished from more complicated anomalies with a component of pulmonary stenosis. The stenosis is usually valvular rather than infundibular. The cusps are fused. This lesion does not produce cyanosis *per se*, but the increased right heart pressure causes a ball and valve right to left shunt through the foramen ovale.

Symptoms: The presenting complaints are poor exercise tolerance and tiring easily with squatting. Cyanosis depends on patency of the foramen ovale. If the heart is compensated, there probably will be no other symptom.

Signs: There is a harsh pulmonary systolic murmur and thrill and there may be some heart enlargement. The pulmonary second sound is weak or absent.

Diagnostic Tests: X-ray film reveals post-stenotic dilatation of the pulmonary artery, decreased pulmonary vascular markings, and clear lung fields. Fluoroscopy shows fullness of the pulmonary conus, slight cardiomegaly, and no pulsation in the hila. Electrocardiogram shows right axis deviation and either right ventricular hypertrophy or right bundle branch block. Angiocardiography shows normal dye circulation, pulmonary valvular stenosis and post-stenotic dilatation. Catheterization reveals a pulmonary artery pressure lower than that in the right ventricle.

Treatment: No specific treatment is advised in asymptomatic patients. If, however, there is progressive cardiac enlargement, cyanosis, dyspnea, right ventricular pressure over 80 mm. Hg., or congestive failure, a valvulotomy must be performed. Shunt operations are contraindicated for they fail to relieve the stress on the right ventricle and add to the work of the heart by increasing the amount of blood returned to the left auricle. Following valvulotomy right ventricular pressure falls and pulmonary blood flow increases. Although long term effects cannot yet be evaluated, there is great promise and apparent low mortality following this procedure.

CYANOTIC CONGENITAL HEART DISEASE

Tetralogy of Fallot

This is the most common cyanotic anomaly found in patients living past puberty. It is composed of pulmonary stenosis, dextroposition of the aorta, ventricular septal defect, and right ventricular hypertrophy.

Symptoms: Usually cyanosis may not be apparent until the child is three to six months old. Feeding is difficult and growth is retarded. There is decrease in exercise tolerance and often the child assumes a characteristic squatting position at play. There may be severe attacks of paroxysmal dyspnea. This may be the presenting symptom, especially if the child is very young. Sitting and walking are delayed. Occasionally the child has syncopal or convulsive tendency.

Signs: Cyanosis is usually obvious. There may be clubbing of the fingers and toes. The heart is usually apparently small, though right ventricular hypertrophy may be severe enough to cause left chest deformity. There is a basal thrill, and a systolic diamond shaped murmur in the second or third left interspace near the sternum. Both are louder in the recumbent than erect position. The pulmonary second sound is diminished. An increase in cyanosis indicates an increase in severity and a diminution of the murmur.

Diagnostic Tests: Blood count reveals polycythemia to the limits of 10,000,000 red blood cells, and a high hematocrit. Oxygen saturation of

arterial blood is decreased. X-ray film reveals a "wooden shoe" heart. There is a concave pulmonary conus and decreased pulmonary vascularity. Fluoroscopy reveals a clear pulmonary window, no vascular pulsation, translucent lungs, small heart in the transverse diameter, and a concave pulmonary segment. Electrocardiogram shows right axis deviation, right ventricular hypertrophy, and large and peaked P waves in lead II. Angiocardiography allows view of the degree of overriding of the aorta, position of the aorta, and determination of which side is best suited for anastomosis. Catheterization confirms the pulmonary stenosis, may enter the aorta from the right ventricle, decreased pulmonary blood pressure, and increased right ventricular pressure. Circulation time from arm to tongue is short.

Treatment: Since life expectancy without surgery is about 12 to 15 years, surgery must be considered in every case. The principle of surgery at present is to create an artificial patent ductus, or a left to right shunt to supply the lungs with necessary blood for oxygenation. The Blalock procedure or the Potts modification are of choice at present. Direct valvulotomy has offered varied results, but surely is not the final word. Extracorporeal surgery may unveil many answers to a malady in which both mortality and morbidity are otherwise gloomy. A 35 per cent mortality in babies under one year is probably due to desperation of operation at that time.

Complete Transposition of the Great Vessels

In this anomaly, the aorta carries venous blood systemically while the pulmonary artery carries arterial blood back to the lungs. Life can be maintained only by the presence of intercirculation communications. This disease takes the life of more cyanotic babies under six months old than any other abnormality.

Symptoms: Cyanosis develops after birth. The baby fails to gain weight, has repeated upper respiratory infections, rapid breathing, and dyspnea.

Signs: Cyanosis in the head and upper extremities are more apparent than in the legs while the ductus is patent. There is a loud harsh systolic murmur in the third or fourth left interspace near the sternum. There is progressive heart enlargement, gallop rhythm, congestion of the lungs, bulging of the chest, and liver engorgement.

Diagnostic Tests: X-ray film shows right and left ventricular enlargement, narrow great vessel shadow in the PA view and wide in the left oblique anterior view. There are increased vascular markings. Electrocardiogram reveals right axis deviation and right ventricular hypertrophy. Blood test reveals polycythemia. Angiocardiography shows the aorta filling fast and remaining opaque. There is no dye in the pulmonary artery. On catheterization the catheter enters the aorta from the right ventricle.

Treatment: At present only the formation of an atrial septal defect along with a systemic-pulmonary anastomosis (Blalock) is the best that surgeons can offer. Retransfer of the great vessels so far has not been successful, even with hypothermia and heart-lung preparations.

Tricuspid Atresia

This abnormality is usually associated with hypoplastic right ventricle, pulmonary stenosis, and septal defects. Blood flows from right auricle to left auricle, mixes with blood from the lungs, and then to the left ventricle. From here some flows to the right ventricle, through the stenotic pulmonary valve to the lungs.

Symptoms: Presenting symptoms are similar to those in tetralogy of Fallot, except that cyanosis and dyspnea are more extreme. Those affected are slow to gain weight and tire easily.

Signs: There is clubbing of the fingers, left chest deformity, and palpable liver pulsations. Also a systolic murmur in the second left interspace near the sternum is present.

Diagnostic Tests: X-ray film and fluoroscopy show an enlarged heart, poor lung vascularity, no hilar pulsations, concave pulmonary conus, and small right ventricle. Electrocardiogram reveals left ventricular hypertrophy and left axis deviation. This is the only cyanotic congenital heart anomaly with left heart strain. Angiocardiography shows no dye in the right ventricle, communication between the right and left atria, direct aortic filling, and poor lung vascularity. The presence of a dilated pulmonary artery is necessary for surgery. Catheterization reveals increased right atrial pressure. The catheter enters the left atrium but cannot enter the right ventricle.

Treatment: Surgery is indicated generally only in seriously incapacitated patients. A shunt operation (Blalock) seems to offer improvement but not as much as in tetralogy. There is a high mortality rate, but without surgery the average life expectancy is only three to six months.

Eisenmenger Complex

This condition is identical to tetralogy except there is no pulmonary stenosis or right ventricular hypertrophy.

Symptoms: Patients present late cyanosis on exertion, fair exercise tolerance, repeated bronchitis, and hemoptysis. The cyanosis presents around age 30 years because of secondary pulmonary sclerosis due to increased pulmonary pressure.

Signs: There is slight cardiac enlargement, thrill, and a loud, harsh, rasping systolic murmur in the basal area radiating through the arterial tree. The pulmonary second sound is accentuated. Clubbing manifests late. Early there may be only left ventricular hypertrophy, for the right ventricular hypertrophy develops as pulmonary pressure increases.

Diagnostic Tests: X-ray film and fluoroscopy reveal the heart enlarged in its transverse diameter, pulmonary segment either normal or prominent, hilar dance, and narrow vascular shadows. Electrocardiogram shows left or right axis deviation and left and right ventricular hypertrophy. S is deep in lead I and S-T_1 may be elevated. Angiocardiography shows overriding aorta with normal vascularity. Catheterization reveals increased pressure in the right ventricle, and pulmonary hypertension. Oxygen

saturation in the pulmonary artery is higher than in the right ventricle or right atrium. Oxygen in arterial blood is diminished.

Treatment: There is no satisfactory treatment for this malady. A shunt operation is contraindicated for it would further increase the pulmonary hypertension.

Taussig-Bing Malformation

This deformity consists of a transposed aorta and a pulmonary artery overriding the interventricular septum.

Symptoms: The most important complaint is cyanosis from birth. There is mild incapacitation, but no squatting or dyspnea.

Signs: There is slight enlargement of the heart and a soft systolic murmur in the pulmonic area. The pulmonary second sound is accentuated and reduplicated.

Diagnostic Tests: X-ray film and fluoroscopy show a full pulmonary conus, increased hilar shadows, and a large right ventricle. Electrocardiogram reveals right axis deviation and right ventricular hypertrophy. Catheterization shows oxygen saturation in the pulmonary artery greater than that in the aorta.

Treatment: Since this is a relatively newly described complex, treatment cannot be well correlated. At present the treatment of choice is creation of an atrial septal defect.

Management of Patients with Cardiovascular Anomalies

Medical: Infants and children should not be limited in activity except in the presence of pulmonary stenosis or severe coarctation. If there is decrease in exercise tolerance, the child will sufficiently limit himself. If tolerance is markedly limited, graded exercises should be inaugurated. It is important psychologically for these children to attend school and participate as nearly normally as possible. Routine immunizations should be instituted unless the child is ill. Good oral hygiene is of the utmost importance and prophylactic antibiotics should be given before extraction. Tonsillectomy is indicated more in congenital heart disease than in the normal population. Operations should be performed as needed. Pregnancy should be undertaken only if the heart is not enlarged and is functioning well. Intercurrent illnesses should be handled as if in a normal person. If cyanosis is persistent, one must guard against thrombosis and dehydration. Treatment for convulsions and thrombosis must be treated with venisection, oxygen, fluids, and heparin. Pneumonia and subacute bacterial endocarditis must be treated immediately with antibiotics. Cardiac failure is managed with bed rest, venisection, oxygen, diuretics, and digitalis.

Surgical: The surgical procedures now used have been described with the individual abnormalities. The future still offers great improvement in surgical management of many lesions, and extracorporeal surgery under hypothermic conditions seem to be the most promising of techniques still in the experimental and developmental stages. It is understood that none

of these delicate procedures would be possible without the assistance of an expert anesthesiologist.

SUMMARY

The classification, diagnosis, special diagnostic tests, and treatment of the more common congenital cardiovascular anomalies have been discussed. The indiscriminate use of angiocardiography and catheterization is discouraged, but must be used when diagnosis may not otherwise be made. Emphasis has been stressed that diagnosis in most instances can be made by an acute physician on history and physical examination alone if he retains a high index of suspicion.

RESUMEN

Se ha discutido la clasificación, el diagnóstico, las pruebas diagnósticas especiales y el tratamiento de las anomalías cardiovasculares congénitas más comunes.

El uso indiscriminado de la angiocardiografía y de la cateterización se desaconseja, pero debe ser usado cuando el diagnóstico no puede ser logrado de otro modo.

Se ha enfatizado, que el diagnóstico en la mayor parte de las circunstancias puede ser hecho por un clínico perspicaz basado únicamente en la historia y en el examen físico si guarda un alto grado de sospecha.

RESUME

L'auteur fait une revue critique de la classification, du diagnostic, des tests particuliers de différenciation et du traitement des anomalies cardiovasculaires congénitales les plus communes. L'emploi sans discrimination de l'angiocardiographie et du cathétérisme est déconseillé, mais ces techniques peuvent être utilisées lorsque le diagnostic ne peut pas être établi autrement.

Il met l'accent sur le fait que le diagnostic dans la plupart des cas peut être établi par un médecin entrainé, sur le seul interrogatoire du malade et l'examen physique, si la possibilité d'une telle éventualité retient son attention.

ZUSAMMENFASSUNG

Es werden Klassifizierung, Diagnose, spezielle diagnostische Untersuchungen und die Behandlung der häufigeren kongenitalen cardiovasculären Anomalien beschrieben. Die kritiklose Anwendung von Angiokardiographie und Katheterisierung ist abzulehnen; die genannten Methoden müssen aber angewandt werden, wenn die Diagnose nicht auf andere Art gestellt werden kann. Es wird besonders darauf hingewiesen, dass in den meisten Fällen die Diagnose durch einen tüchtigen Arzt aus Anamnese und klinischer Untersuchung allein gestellt werden kann, wenn ein hinreichender Verdacht vorliegt.

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An Experience with Segmental Resection in the Treatment of Pulmonary Tuberculosis

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The surgical treatment of pulmonary tuberculosis has occupied a progressively greater role in the therapeutic armamentarium. However, surgical intervention consisting of pulmonary resection is a relatively old concept. Block[1] in 1881 was aware of its possibilities. The concept of excision of diseased areas has been fostered by surgical prophets for many years. A few desperation cases were treated from time to time by pneumonectomy or lobectomy. Friedlander[2] in 1935 discussed the role of lobectomy in pulmonary tuberculosis. In 1939, Jones and Dolley[3] reported four cases treated by pneumonectomy or lobectomy. Some of these early results were good, but the overall results were discouraging.

Overholt[4] in 1945 reported the largest individual series of resections at that time. The following year, the same author[5] in a review of resection cases from 1934 to 1946 was able to find 192 patients having a total of 127 pneumonectomies and 73 lobectomies.

Strong impetus was given to pulmonary resection in tuberculosis by the general improvement in thoracic surgery techniques. Improvements in anesthesia, blood transfusions, and greater understanding of pulmonary physiology awakened new interest in the possibility of resection in this disease. With the advent of modern anti-tuberculous drugs, started by Waksman with streptomycin, resectional surgery was becoming increasingly common. With modern drug therapy, it was repeatedly demonstrated that morbidity and mortality rate in resectional surgery was held to an acceptable level.

Foremost in the minds of all advocates of resectional surgery has been the conservation of pulmonary tissue. Following the demonstration by Blades[6] and Churchill[7] of the technical feasibility of segmental resection, this procedure is now established on firm ground. After the demonstration of the feasibility of segmental resection in non-tuberculous conditions, it was but a short step to attempt to apply this measure in tuberculosis. Segmental resection is now a widely accepted procedure in minimal, moderate, and far advanced pulmonary tuberculosis. Wedge resection, still aiming at conservation of pulmonary tissue, is also a standard procedure either alone or combined with other forms of resection.

It is the purpose of this paper to present our experiences with 182 consecutive segmental resections in pulmonary tuberculosis from 1951 to 1954. In this paper, segmental resection may be the only procedure or it may be combined with other forms of resection, either lobe or wedge. By segmental resection, we mean an anatomical dissection based on the

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Segmental Resections

TABLE I
AGE DISTRIBUTION

Age	Number	Per Cent
Under 20	16	9
20 to 40	116	64
40 or over	50	27
TOTAL	182	100

bronchovascular pattern. Wedge resection is an excision from the periphery with dissection toward the hilum without regard for anatomical landmarks.

The above table shows age distribution of patients in this review. Sixteen (9 per cent) were under the age of 20; 116 (64 per cent) were between 20 and 40; and 50 (27 per cent) were 40 or over.

TABLE II
SEX AND COLOR

	White	Colored	Total
Females	69	23	92
Males	64	26	90
TOTAL	133	49	182

The above table shows the sex and color distribution of the patients in this study. There were 69 white females and 23 colored females for a total of 92 females. There were 64 white males and 26 colored males for a total of 90 male patients.

TABLE III
EXTENT OF DISEASE

	Number	Per Cent
Minimal	1	00.3
Moderate	105	58.0
Far	76	41.7
TOTAL	182	100.0

The above table shows the extent of disease in this group of patients at the time of admission to the sanatorium. One (00.3 per cent) had minimal disease; 105 (58 per cent) had moderately advanced disease; 76 (41.7 per cent) had far advanced pulmonary tuberculosis. It is rarely that we see a case of minimal tuberculosis in this institution.

The following table shows the sputum status on admission to the sanatorium. One hundred sixty-one (89 per cent) were found to be positive and 21 (11 per cent) were negative.

TABLE IV
SPUTUM STATUS ON ADMISSION

	Number	Per Cent
Positive	161	89
Negative	21	11
TOTAL	182	100

Preoperative Therapy

Bed rest remains a constant factor and a basis for treatment of pulmonary tuberculosis. In addition to bed rest, collapse measures and antimicrobial drugs are used. Surgical resection is an additional adjunct that is employed in selected cases.

TABLE V
COLLAPSE MEASURES PRIOR TO SURGERY

	Number	Per Cent
Treatment with collapse	141	77
No collapse	41	23
TOTAL	182	100
Type of Collapse		
Pneumoperitoneum	116	
Pneumothorax	14	
Thoracoplasty	11	
Phrenic interruption	31	
	182	—Collapse procedures on 141 patients

A review of collapse measures used prior to surgery in these 182 consecutively treated patients shows that 141 (77 per cent) had been treated with, and 41 (23 per cent) without collapse. The type of collapse is also shown. One hundred sixteen received pneumoperitoneum; 14 pneumothorax; 11 thoracoplasty; and 31 phrenic interruption. One hundred eighty-two collapse procedures had been used on 141 patients, showing that some of them had received more than one type of collapse.

TABLE VI
ANTIMICROBIAL TREATMENT PREOPERATIVELY

	Number	Per Cent
Received treatment	161	89
None preoperatively	21	11
TOTAL	182	100

Antimicrobial therapy plays an important part in present day therapy of pulmonary tuberculosis. One hundred sixty-one (89 per cent) had received antimicrobial drugs preoperatively and 21 (11 per cent) had none. Those receiving no drugs preoperatively were in the early years of this study.

TABLE VII
DURATION OF ANTIMICROBIAL TREATMENT BEFORE SURGERY

Months	Patients	Months	Patients
None	21	6 to 12	53
Under 1	18	12 to 18	25
1 to 6	51	18 and over	14
TOTALS	90		92

The above table shows that 21 had received no antimicrobial drugs prior to surgery; 18 had been on drugs less than one month prior to surgery; 51 from one to six months; 53 for a period of six to 12 months; 25 for 12 to 18 months; and 14 for 18 months or longer, prior to the addition of surgery to the therapeutic regime. Ninety patients had received less than six months of antimicrobial drugs, while 92 had received them over six months.

TABLE VIII
IMMEDIATE PREOPERATIVE SPUTUM STATUS

	Number	Per Cent
Negative (always)	14	8
(+) Within 1 month	25	14
(+) Within 6 months	79	43
(—) More than 6 months since (+)	64	35
TOTALS	182	100

The above table reveals the preoperative sputum status on this group of 182 patients. Fourteen (8 per cent) had been negative during their entire preoperative hospital stay; 25 (14 per cent) had been positive within one month of the time they were operated; 79 (43 per cent) had been positive within the last six months; 64 (35 per cent) had been negative for six months or longer, prior to surgical intervention.

Indications for the Addition of Surgery

We are aware of the present-day controversy over long term drug administration alone versus long term use of drugs in conjunction with other accepted methods of treatment. A high percentage of patients have sputum conversion on drugs alone. We have felt that an open cavitary lesion, whether the sputum was positive or negative, was a clearcut indication for surgical intervention after failure of the cavity to close with accepted methods of treatment. We have felt that tuberculous fibrocaseous residue was another indication for surgery. The areas of tuberculous residue that have been resected have been either in the form of filled cavities or the end results of coalescence of exudative disease. We have leaned more toward resection of filled cavities than of coalescence of exudative disease, particularly when the filled cavity has measured more than 2 cm. in diameter. We have used bronchograms preoperatively to a

great degree, and the presence or absence of bronchiectasis has influenced us in many instances toward the use of excisional surgery.

Extensive bilateral disease or extrapulmonary diseases of various types may exclude patients from excisional surgery.

We have primarily operated on patients with disease localized in a lobe and one additional segment, or on those with disease localized in one or two segments of a particular lobe. Cavitary or fibrocaseous disease localized in the anatomical manner as mentioned above, with the remaining lung fields primarily stable, have been our main indications. It may be necessary to do lobectomy, such as the upper lobe, and then do segmental resection to remove foci of disease located in the superior segment of the lower lobe. All patients must be considered acceptable surgical material by general standards.

TABLE IX
EXTENT OF SURGERY

		Number	Per Cent
Wedge or subsegment	40		
One segment only	28		
More than 1 segment, less than 1 lobe	79		
		147	80
One lobe and segment or wedge	37		
Two lobes and segment or wedge	2		
		39	20
TOTAL		186	

The above table shows the extent of surgery that was carried out. Forty had a wedge or a subsegment removed; 28 had a segment only; 79 had more than one segment, but less than one lobe. One hundred forty-seven (80 per cent) had less than a lobe removed; 39 (20 per cent) had lobectomy plus smaller portions of an additional lobe removed. Many combinations have been used throughout this series. There were 186 surgical procedures on 182 patients, as four had bilateral resections.

TABLE X
PATHOLOGY

Open cavities	59
Tuberculous residue	162
Bronchiectasis	69

Three specimens were not examined pathologically or bacteriologically. A review of pathological reports on these 183 surgical specimens shows that the pathology was varied, as were the preoperative indications. In these pathological specimens there were 59 open cavities; 62 areas of

TABLE XI
BACTERIOLOGY ON RESECTED SPECIMENS

Year	(+) D.S.	(+) Culture	Total No. Specimens
1951	12	9	12
1952	44	23	57
1953	65	32	82
1954 (to 6/24)	27	3	32
	148 (80 per cent)	67 (36 per cent)	183

tuberculous residue of varying sizes, shapes, and manner of origin; and 69 specimens revealing bronchiectasis.

Bacteriology of resected specimens has been of great interest. In 1951 all 12 cases treated with this type of excisional surgery were positive to direct smear and nine were positive to culture. In 1952, 44 of the 57 specimens were positive to direct smear and 23 of the specimens revealed positive cultures. In 1953, 65 of 81 specimens were positive to direct smear and 32 were positive to culture. In 1954, 27 of the 32 specimens included were positive to direct smear and only three were positive to culture. Three specimens were not examined bacteriologically. Of the 183 surgical specimens from these 182 patients, 148 (80 per cent) were positive to direct smear and 67 (36 per cent) revealed positive cultures. There were some open cavitary lesions as well as closed lesions which failed to give positive cultures.

Morbidity and Mortality

In this group, a raw or potentially raw surface left behind by excisional surgery has been a common denominator. What are the morbidity and mortality rates associated with this type of therapy?

TABLE XII
MORBIDITY AND MORTALITY

	Number	Per Cent
1. Uncomplicated	146	80
2. Complicated	36	20
3. Deaths	2	01.1

One hundred forty-six (80 per cent) of these patients had an entirely uneventful postoperative course; 36 (20 per cent) had a complicated postoperative course; there were two (01.1 per cent) who died directly as a result of surgical therapy.

Three patients in this series had cardiac arrest, and two of them died on the operating table as a result of this complication. These two were the most distressing of the series as both were young and had had negative sputum to culture for more than six months preoperatively on drug therapy.

TABLE XIII
MORBIDITY AND COMPLICATIONS

Complication	No.	Treatment of Complication	End Result
1. Cardiac arrest	3	Cardiac massage (3)	2 deaths
2. Air leaks			
a. Prolonged	22	Catheter reinsertion (9)	Excellent
b. BPF	3	Thoracoplasty (12)	Excellent
c. Empyema	1		
3. Postop. hemorrhage	4	Thoracotomy (3)	Excellent
4. Transfusion reaction	1	Supportive	Excellent
5. Wound infection	4	Incision & drainage	Good
6. Pleurisy	1	Supportive	Excellent
7. Paralytic ileus	1	Decompression	Excellent
8. Retention of secretions	1	Bronchoscopy	Excellent
9. P.O. asthma	1	Medical treatment	Excellent
10. Atelectasis	2	Bronchoscopy (2)	Excellent
11. Dyspnea & cyanosis	1	Oxygen therapy	Good
TOTAL	45		

Both of them had had enough disease to warrant lobectomy plus segmental resection.

Air leaks in the postoperative period accounted for more than half the total number of complications. There were 22 who had residual air pockets that demanded further therapy; three had definitely demonstrated bronchopleural fistulae; and one had proved empyema. Catheter reinsertion was necessary on nine. Post-excisional thoracoplasty was necessary on 12. The end results were excellent in all, so that while complications added to the morbidity rate they presented few unsolved problems.

There were four who had severe postoperative hemorrhages; in three of them it was necessary to do exploratory thoracotomy in the immediate postoperative period to control bleeding within the hemithorax. The end results were excellent in all four.

The other complications were of less consequence. One had a transfusion reaction; four, wound infections; one, pleurisy; one, paralytic ileus; one, retention of secretions without atelectasis; one, postoperative asthma; two, postoperative atelectasis and one, rather severe dyspnea and cyanosis because of pulmonary insufficiency.

All these received antimicrobial therapy for at least three months postoperatively.

Post-Surgical Period

We would now like to present the follow-up on this group of patients after the immediate postoperative period.

The status in regard to hospitalization reveals that 130 have been discharged from the institution. One hundred twenty-five of them were inactive, three were active and two were dead, both from cardiac arrest. Of the three discharged with active disease, one (discharged against medical advice) had positive culture with a contralateral lesion for which

TABLE XIV

Hospital Status	Inactive	Active	Dead	Average Stay Postop.
130 Discharged	125	3	2	9.6 months
	Negative	Positive		
52 Hospitalized	49	3		8.5 months

surgery had been recommended and refused; the other two were discharged with consent and advice. One of them had 12 and the other had 28 consecutive negative cultures. Both of them returned one positive culture out of three submitted in the week prior to discharge from the hospital. They have had no further positive sputa.

Fifty-two are still hospitalized; 49 of them are negative to culture; three are positive. One has a contralateral lesion for which surgery has been approved. One has atypical acid fast organism and is a candidate for further surgery. The third, who has been through the gamut including long term drug therapy of over two years, pneumothorax, intrapleural pneumonolysis, thoracoplasty, and resection, left the hospital against medical advice and is back with positive sputum.

We found that the patients discharged remained for an average of 9.6 months following surgery. Of the 52 still in the hospital, the average time since surgery up to September of 1954 is 8.5 months.

Of the 130 discharged, follow-up is available on 107. These were followed up from the standpoint of (1) physical activity, (2) sputum status, and (3) x-ray studies.

TABLE XV
PRESENT STATUS OF DISCHARGED PATIENTS

Follow-up available	107
No follow-up	23
TOTAL	130

Activity		Sputum status		X-ray	
Full	56	Negative	96	Stationary	79
Daily rest periods	50	Positive	2	Better	16
Dead	1	Not done	8	Worse	1
				No x-ray	10
	107		106		106

Fifty-six have returned to full activity and 50 of them are still observing daily rest periods. One young, white male committed suicide, yet up to that time he was well and working full time. The sputum status study revealed that 96 were negative, two positive, and eight had only recently received medical discharges from the hospital and were negative at that time. Seventy-nine had stationary x-ray film shadows, 16 had shown roentgenological improvement, one was worse roentgenologically and 10 had not had x-ray films since discharge.

The average period of follow-up after hospitalization was 12.3 months.

Comment

We are enthusiastic in the use of segmental resection in the treatment of pulmonary tuberculosis. We feel that it is a safe procedure. Our mortality figures are low, and the morbidity rate is acceptable. We have had few serious complications. We feel that it is extremely useful in removing major foci of disease and open cavitary lesions and at the same time conserving the maximum amount of lung tissue.

SUMMARY

1. One hundred eighty-two consecutively treated patients, all having had segmental resections as well as other types of therapy, have been reviewed.

2. At the time of hospital admission 99.7 per cent had moderate or far advanced pulmonary tuberculosis. Eighty-nine per cent had positive sputum.

3. All had similar therapy—bed rest, antimicrobial drugs, and excisional surgery—and 77 per cent of them had received collapse therapy.

4. Fifty-seven per cent were positive within a six-month period prior to surgery. Ninety-two per cent had been positive during preoperative treatment.

5. The early mortality rate was 1.1 per cent. The morbidity rate was 20 per cent. All complications, except the two cardiac arrests leading to death, were otherwise amenable to further treatment.

6. At present, eight (4.3 per cent) of the 182 patients are treatment failures. There were three deaths, two in the hospital and one (suicide) in the post hospital follow-up. There are three in the hospital with positive sputum whose treatment has not been concluded. There are two on the outside with positive sputum, one of whom had positive sputum four months ago and has no evidence of relapse clinically or by x-ray shadows. The other has positive sputum and relapse shown by x-ray film.

7. Of the remaining 176 (95.7 per cent of the total), there are 49 who remain in the hospital with an average post surgical stay to date of 8.5 months, and their therapy is successful to date. The other 127 discharged patients have an average follow-up since surgery of 22 months. We are certain of the status of 106 (85 per cent of the total). We have so far been unable to secure information on 23 (10.7 per cent of the total).

RESUMEN

1. Se hizo una revisión de 182 enfermos consecutivos tratados con resección segmentaria así como con otras formas de tratamiento.

2. Al ingresar al hospital, 99.7 por ciento estaban clasificados como moderados o muy avanzados tuberculosos pulmonares. Ochenta y nueve por ciento tenían esputos positivos.

3. Todos se sujetaron a un tratamiento similar: reposo en cama. drogas antimicrobianas, cirugía de excisión, y 77 por ciento de ellos habían tenido colapsoterapia.

4. Cincuenta y siete por ciento eran positivos dentro de los seis meses

anteriores a la cirugía. Noventa y dos por ciento habían sido positivos durante el período preoperatorio.

5. La mortalidad inmediata fué de 1.1 por ciento. La morbilidad fué de 20 por ciento. Todas las complicaciones con excepción de dos paros cardiacos que produjeron la muerte, fueron susceptibles de tratarse.

6. En la actualidad, ocho (4.3 por ciento) de los 182 enfermos son fracasos. Hubo tres muertes, dos en el hospital y una (suicidio) durante el seguimiento posthospitalario.

Hay tres enfermos en el hospital con esputo positivo cuyo tratamiento no ha concluído. Hay dos entre los externos con esputo positivo, uno que ha tenido esputo positivo desde hace cuatro meses y notiene evidencia clínica ni radiológica. El otro es positivo con recaída aparente a los rayos X.

7. De los restantes 176, 95.9 por ciento del total, hay 49 que permanecen en el hospital con una estancia postoperatoria de 8.5 meses y su tratamiento es satisfactorio hasta ahora.

Los otros 127 que han salido se han seguido por término medio durante 22 meses. Estamos seguros de las condiciones de 106 (85 por ciento del total). No hemos podido tener información de 23 (10.7 por ciento del total).

RESUME

1. L'auteur a passé en revue 182 malades traités successivement par résections segmentaires plus ou moins associées à d'autres types de traitement.

2. Au moment de leur entrée à l'Hôpital, 99,7% de ces malades étaient porteurs de tuberculose pulmonaire modérée ou sérieuse. 89% avaient une expectoration positive.

3. Tous les malades reçurent un traitement semblable (repos intégral au lit, chimiothérapie, exérèse chirurgicale) et 77% d'entre eux subirent une collapsothérapie.

4. 57% des malades eurent des expectorations positives au cours des six mois qui précédèrent l'acte chirurgical. 92% avaient été positifs pendant la phase de traitement préopératoire.

5. Le taux de la mortalité post-opératoire fut de 1,1%. Le taux de la morbidité fut de 20%. Toutes les complications, à l'exception de deux arrêts cardiaques ayant provoqué la mort, purent être l'objet d'un traitement ultérieur.

6. Actuellement, 8 des 182 malades (4,3%) constituent des échecs au traitement. Il y eut trois décè, deux à l'hôpital et un (suicide)) pendant la période de contrôle après la sortie de l'Hôpital. Il y a trois malades à l'Hôpital qui ont encore leur expectoration positive, et dont le traitement n'est pas terminé. Deux malades sortis de l'Hôpital ont encore leur expectoration positive, l'un d'eux avait une expectoration positive quatre mois auparavant, et ne présente aucun signe clinique ou radiologique de rechute, l'autre a une expectoration positive et présente une rechute visible radiologiquement.

7. Parmi le reste des 176 malades (95,7%) il y en a 49 qui restent hospitalisés, avec un séjour moyen de 8 mois et demis, et leur traitement

est actuellement satisfaisant. Les 127 autres malades sortis de l'Hôpital ont été suivis depuis l'intervention pendant une moyenne de 22 mois. L'état pulmonaire de 106 malades (85% du total) est satisfaisant. Jusqu'à présent, l'auteur n'a pu obtenir aucune indication au sujet de 27 malades (10,7% du total).

ZUSAMMENFASSUNG

1. Es wurden 182 fortlaufend behandelte Kranke geprüft, die alle sowohl Segmentresektionen als auch anderen Behandlungsarten unterzogen wurden.

2. Zum Zeitpunkt der Aufnahme ins Krankenhaus hatten 99,7% mässig oder weit fortgeschrittene Lungentuberkulose. 89% hatten Tuberkalbakterien im Auswurf.

3. Alle wurden ähnlich behandelt: Bettruhe, tuberkulostatische Medikamente und Resektionstherapie; 77% von ihnen erhielten Kollaps-Therapie.

4. 57% waren 6 Monate lang vor der Operation TB-positiv. 92% waren während der praeoperativen Behandlung überhaupt positiv gewesen.

5. Die Frühmortalität betrug 1,1%. Die Morbiditätsquote belief sich auf 20%. Alle Komplikationen—mit Ausnahme von 2 Fällen tödlichen Herzstillstandes—konnten durch entsprechende Behandlung beherrscht werden.

6. Zur Zeit stellen 8 (= 4,3%) von den 182 Kranken Behandlungs-Misserfolge dar. Es ereigneten sich 3 Todesfälle: davon 2 im Krankenhaus und ein Selbstmord nach der Entlassung. 3 Patienten, deren Behandlung noch nicht beendet ist, sind weiterhin positiv. 2 Patienten behielten nach der Entlassung positives Sputum: der eine von ihnen hatte vor vier Monaten Tuberkelbakterien im Auswurf, ohne dass klinisch oder röntgenologisch ein Rückfall nachweisbar war; bei dem anderen war sowohl positiver Auswurf als auch röntgenologisch ein Rezidix nachweisbar.

7. Von den restlichen 176 Kranken (=95,7%) aller beobachteten Patienten verblieben 49 Kranke durchschnittlich 8,5 Monate nach dem operativen Eingriff im Krankenhaus, und ihre Behandlung ist bis heute erfolgreich. Die anderen 122 entlassenen Patienten sind durchschnittlich über 22 Monate nach dem operativen Eingriff beobachtet worden. Bei 106 Kranken (= 85%) ist der Befund genau bekannt. Über 23 Patienten (= 10,7%) konnte bisher nichts Sicheres in Erfahrung gebracht werden.

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The Value of Bacteriological Studies in Pneumonia Occurring in Age Group 15-60

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The purpose of this study was to evaluate the routine need for bacteriological studies as a guide to therapy and prognosis of patients with pneumonia in a selected age group. Bacteriological studies in pneumonia may be of value for diagnosis, treatment, prognosis, and epidemiology. The clinician is interested in bacteriological studies primarily because they may serve as a guide to treatment. Although the literature contains relatively little statistical evidence, it is entirely logical to expect that the type of antibiotic treatment could be determined from bacteriological studies. For this reason, the opinion is generally held that the type of antibiotic treatment should depend upon the results of appropriate bacteriological investigation. The positive correlation between results of bacteriological studies and the subsequent response to therapy is evident to everyone treating pneumonia. However, it does not necessarily follow that bacteriological studies are essential to the satisfactory treatment of all patients with pneumonia.

Several factors need to be considered when investigating this subject. The chief means of bacteriological examination in pneumonia are by blood culture, throat smear and culture, and sputum smear and culture. Except for an occasional contaminant which is usually recognizable as such, a positive blood culture is a reliable indication of the cause of infection. Unfortunately the blood culture is usually sterile, and even when positive, one or more days are required before the organism can be cultured and identified. Specimens obtained from the throat always contain the normal inhabitants which are seldom pathogenic. It is not rare to find that the causative organism in a case of pneumonia is not reported on either smear or culture from the throat. On rare occasion the causative agent may not even be found in sputum specimens. It may be that a carefully collected and promptly examined sputum specimen is more desirable than the usual routine method; however, this is not a common practice. Sometimes it is impossible for the patient to produce a satisfactory sample of sputum. Since it is a frequent experience to obtain a mixture of organisms without a predominant pathogen, it is often difficult to interpret the results of cultures, and sometimes they may even be misleading. When *in vitro* antibiotic sensitivity tests are used as a guide to therapy, some degree of success may be expected, but exceptions are not rare. Two days are routinely required after collecting the specimen before the results of *in vitro* antibiotic sensitivity tests are available. Treatment of the patient can not be delayed for this length of time. Thus it is apparent that be-

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cause of occasional inherent inadequacies and the necessary time delay, the final results of bacteriological studies can not be expected to serve as a satisfactory routine guide to therapy. A simple and rapid method of classifying cases of pneumonia for the purpose of initial treatment is needed.

It is not always easy to determine the bacteriological cause of a case of pneumonia. However, in a series of 2500 cases reported by Dowling[1] it was considered that the pneumococcus was the causative organism in 98 per cent of all cases of primary bacterial pneumonia. The Streptococcus hemolyticus, Staphylococcus aureus, Streptococcus viridans, Friedlander's bacillus, Hemophilus influenza, and other organisms are considered to be causative in the small remaining group of bacterial pneumonias. Particularly in the younger age group a number of different viruses are responsible for a small but significant proportion of all pneumonias. Essentially all pneumococci are highly sensitive to penicillin and most other organisms causing bacterial pneumonia are also penicillin sensitive. Although the controversy over the efficacy of antibiotics in viral pneumonias continues, there appears to be no drug which produces a favorable response with resonable uniformity.

Method of Study

All cases with pneumonia in the age group 15-60 years admitted to The Rochester General Hospital from 1948 through 1953 were reviewed. This represented 52.4 per cent of all adult patients with pneumonia admitted during this period. It was decided to include all pneumonias, regardless of etiology, because of the difficulty in making a definite differentiation between bacterial and viral pneumonia in many cases. The material includes both private and ward patients and is considered to represent a good cross-section of the hospital population of this area. The upper age limit of 60 years was selected because of the ever increasing frequency of the manifestations of degenerative diseases beyond that age. With advancing age it would be expected that the virulence of the infecting organism would play a relatively less important role in prognosis. Whereas the factor of host resistance which is difficult to evaluate would play an increasingly important role. The years 1948 through 1953 were selected because of the availability of multiple antimicrobial agents during this period.

All patients were classified as to the presence or absence of coexistent diseases as follows: (1) major coexistent disease (greater severity than the pneumonia), (2) intermediate coexistent disease (severity equal to the pneumonia), (3) minor coexistent disease (severity less than the pneumonia), and (4) no coexistent disease. Although this classification is arbitrary, it serves a useful purpose as will be discussed later. Cases with major coexistent diseases included conditions such as advanced malignancy, severe congestive heart failure, recent myocardial infarction, uremia, diabetic acidosis, and often represented terminal pneumonia. The intermediate coexistent diseases included such conditions as advanced heart disease with no more than mild congestive failure, poorly controlled

diabetes, cirrhosis of the liver of no more than moderate severity, and most congenital chest deformities.

The patients who died were included in the general analysis but were also reviewed separately with particular reference to: (1) presence of coexistent disease, (2) duration of hospitalization, and (3) bacteriological studies performed.

Next, all surviving patients were classified according to their response to therapy. The response was considered "good" if either or both of the following criteria were met: (1) less than 10 days hospitalization, and (2) only one antibiotic used during the period of hospitalization. All not meeting this requirement were classified as having a "poor" response.

Extensive data were collected upon detailed analysis of that portion of the "poor" response group having minor or no coexistent diseases. This might be called the "unanticipated poor response" group. Particular attention was paid to the results of any bacteriological studies performed in relation to the antibiotic therapy used. It was hoped that reasons for the poor response could be determined. Finally, in each of these cases an opinion was formed as to whether the bacteriological studies were of value as a guide to therapy.

Results

A total of 625 patients 15 to 60 years of age with pneumonia were admitted to The Rochester General Hospital during the six year period 1948 through 1953. There were 31 individuals in the age group 15 to 20 years, 101 from 20 to 30 years, 104 from 30 to 40 years, 157 from 40 to 50 years, and 232 from 50 to 60 years.

The mortality rate for this group was 8.5 per cent (53 patients) compared to an overall mortality rate of 14.7 per cent in all adults with pneumonia from this hospital during the same period. Table I indicates that the majority of this mortality group had major coexistent diseases and only two had no coexistent disease. It is noteworthy that both of these patients died within two hours after admission and did not receive treatment prior to admission. Of the 12 hospitalized less than 24 hours, six were for even less than 12 hours. However, the majority were hospitalized for more than four days. Reasons for obtaining bacteriological studies in only 23 cases will be brought out under discussion.

TABLE I
PNEUMONIA DEATHS IN AGE GROUP 15-60 FROM 1948-1953 INCLUSIVE
(Total Deaths—53)

1. Coexistent Diseases	
A. Major	40
B. Intermediate	11
C. Minor or none	2
2. Duration of Hospitalization	
A. Less than 24 hours	12
B. One to four days	11
C. More than four days	30
3. Bacteriological Studies	23

Table II presents the response to therapy in relation to the presence of coexistent diseases. Combining those who died with those who had a poor response, it is found that in the group with major coexistent diseases 72 per cent had an unsatisfactory response compared with 29 per cent in the intermediate coexistent disease group and 17 per cent in the minor or no coexistent disease group. The incidence of maximum response (less than 10 days hospitalization plus only one antibiotic) is found to increase significantly as the severity of the coexistent diseases decreases. The prognosis is therefore related to the presence of coexistent disease.

TABLE II
RELATIONSHIP OF COEXISTENT DISEASES TO RESPONSE TO THERAPY OF PATIENTS WITH PNEUMONIA IN THE AGE GROUP 15-60 (625 Patients)

I. Major (92)	15 per cent	Per Cent	Per Cent
A. Dead (40)	43 per cent		
B. Living (52)	57 per cent		
1. Good Response (26)			50
a. Both (b+c) (1)		4	
b. Less than 10d. Hosp. only (2)		8	
c. Single antibiotic only (23)		88	
2. Poor Response (26)			50
II. Intermediate	31 per cent		
A. Dead (11)	6 per cent		
B. Living (182)	94 per cent		
1. Good Response (137)			75
a. Both (b+c) (59)		43	
b. Less than 10d. Hosp. only (11)		8	
c. Single antibiotic only (67)		49	
2. Poor Response (45)			25
III. Minor or None (340)	54 per cent		
A. Dead (2)	0.6 per cent		
B. Living (338)	99.4 per cent		
1. Good Response (282)			83
a. Both (b+c) (165)		59	
b. Less than 10d. Hosp. only (57)		20	
c. Single antibiotic only (60)		21	
2. Poor Response (56)			17

Detailed study was made of the 56 cases with minor or no coexistent diseases but who had poor response. Thirty-six were males and 20 females. The age distribution was not remarkably different from the overall group. Thirty were hospitalized from 10 to 15 days and only four more than 30 days. The white blood count was in the normal range in 13 cases, 10,000—15,000 in 23, and above 15,000 in 20. Cold agglutinins were present in four of the 12 tested. Of the four cases with cold agglutinins, none had white blood counts above 15,000 but only one was normal. Pneumococci were cultured from the sputum in three of these cases and no definite pathogen in the fourth. Chest x-ray film showed unilateral involvement of less than one-third of a lung field in 23, unilateral but greater than one-third of a lung field in 12, and bilateral in 21. Seventeen throat cultures were done in 17 cases. Sputum was examined 95 times in 43 cases. Sixty-two blood cultures were made in 31.

The blood culture was sterile in all but three. Pneumococcus was the organism found in each of the positive blood cultures. The course of the illness was not remarkable in two of them but the third developed empyema and broncho-cutaneous fistula. Nine of the 56 had no bacteriological studies and five had only blood cultures which were sterile. Of the 41 patients in which a stained smear (sputum or throat) was examined, Gram positive cocci were found in 40 and Gram negative bacilli in 26. On culture Friedlander's Bacillus was found in two but was not the predominant organism in either. Staphylococcus aureus was cultured in five but in none was it a pure culture. Pseudomonas was repeatedly obtained in pure culture from one patient. Fungi were found in nine. *In vitro* antibiotic sensitivity tests were performed on 23 occasions in 14 cases. Etiology of the pneumonia was considered to be probably bacterial in 27, indefinite in 26, and probably viral in three. There were three cases of empyema and one of lung abscess but no other serious complications were recorded. The initial antibiotic (single or combined) treatment consisted of penicillin in 48 cases, aureomycin 20, sulfonamides seven, terramycin four, streptomycin three, and chloramphenicol two. The only other antibiotic used at any time was erythromycin. Twenty-four of the 56 patients remained afebrile after the fifth hospital day. In two of the 56 bacteriological studies suggested that the initially used antibiotic was not the drug of choice. However, in no case was there a satisfactory clinical response after change to the antibiotic indicated by *in vitro* sensitivity tests. Thirty-three of the 56 had one or both of the following: (1) less than 15 days hospitalization or (2) no change in the initially ordered antibiotic therapy. It was concluded that bacteriological studies in this poor response group were of no value as a guide to treatment or prognosis in 37. In five the studies were of doubtful value, and in none were they of probable or definite value. No bacteriological studies (except negative blood cultures in five patients) were performed in the remaining 14 cases.

Discussion

An attempt has been made to evaluate a problem which does not readily lend itself to statistical analysis. However, criteria were established which can be defined with relative ease. Opinions were then formulated on the results of this analysis of the data.

This study shows that bacteriological work as done at present in this hospital is of no definite value in determining the type of antibiotic treatment to be used in patients with pneumonia in the age group 15 to 60 years.

Bacteriological studies were done in over three-fourths of this series. There were several reasons for not obtaining them in the remaining cases; however, it is safe to assume that studies were more likely to be ordered in the more seriously ill patients. In the mortality group the chief reasons for the low incidence of bacteriological studies were the obviously fatal prognosis in many cases plus the fact that some of the pneumonias were not diagnosed until autopsy.

Several cases diagnosed on admission as having pneumonia were subsequently found to have tuberculosis. This group was purposely excluded

because special diagnostic techniques are required. Uufortunately tuberculosis will seldom be suspected from routine smears and cultures. All questionable cases should have the special tuberculosis studies. Furthermore, all pulmonary infections should be followed closely by x-ray film until there is complete resolution or until the lesion becomes stable.

The rarity of penicillin resistant organisms in this series needs emphasis. Friedlander's bacillus was found in only two of the poor response group, and probably in neither of these was it the primary pathogen. There has been no case of Friedlander's pneumonia at any age reported at autopsy from this hospital during the six year period of this study. The case in which pseudomonas was the only organism cultured survived even though the organism was resistant by *in vitro* testing to all of the then available antibiotics.

Table II indicates the importance of coexistent diseases as a factor in prognosis. It is felt that this factor is of considerably greater importance than the virulence of the organism responsible for the pneumonia. In fact, in those without significant coexistent disease, and therefore with presumably normal host resistance, the only fatalities were two patients who did not receive treatment until moribund.

A classification of pneumonias occurring in the 15-60 age group based on the severity of coexistent diseases is proposed in Table III. It was rare that the presence of a coexistent disease was not recognized after the initial examination of the patient. In the poor and guarded prognostic groups bacteriological studies may be performed, but it should be realized that even here the results are not likely to be of value as a guide to therapy. In the good prognostic group there appears to be no reason to expect that bacteriological studies would yield information of value for treatment or prognosis. The possibility of a case in the good prognostic group yielding definitely significant positive bacteriological findings indicating that a drug other than penicillin is the drug of choice can not be denied. However, the rarity of this situation is evident. Of the 56 who had "poor" response to treatment as previously defined, only five gave evidence that the bacteriological studies were of even possible (doubtful) value as a guide to treatment. These five represent 1.5 per cent of the good prognostic group in this series. If a patient in the good prognostic group does not respond to penicillin within 48 hours, it then

TABLE III

CLASSIFICATION OF PNEUMONIA IN THE AGE GROUP 15-60 FOR PURPOSES OF PROGNOSIS AND AS A GUIDE TO TREATMENT

1.	Poor Prognosis—cases in which there is a coexistent disease of major proportions. Therapy is difficult and usually unsatisfactory.
2.	Guarded Prognosis—cases in which there is a coexistent disease of equal significance to the pneumonia. The less common organisms are probably more likely to be found. Response to therapy is unpredictable.
3.	Good Prognosis—cases in which there is no coexistent disease or one of minor significance. This group should include the majority of patients seen in private practice. Response to antibiotic therapy is uniformly good. Hospitalization and bacteriological studies are necessary only in the exceptional case.

seems advisable to get bacteriological studies. Also it seems equally if not more important to look further for a previously unrecognized coexistent disease.

Although only 28 per cent of all adults with pneumonia in this hospital fell into the good prognostic group, most patients with pneumonia are no longer hospitalized. It is estimated that at least one-half of all pneumonia patients seen in private practice fall into the good prognostic group.

Acknowledgement: The author wishes to express his sincere appreciation to Christopher Parnall, Jr., M.D., F.A.C.P., Director of Medical Education, Rochester General Hospital, for the assistance given in conducting this study and in the preparation of the manuscript.

SUMMARY AND CONCLUSIONS

1. In the age group 15-60, 625 cases with pneumonia admitted to The Rochester General Hospital from 1948 through 1953 were reviewed.

2. Particular attention was paid to coexistent diseases and bacteriological studies in relation to the course of the disease and the treatment received.

3. With routine antibiotic therapy the course of the disease was dependent more upon the presence of coexistent disease than upon the virulence of the causative organism.

4. In 340 cases of pneumonia without significant coexistent diseases, bacteriological studies were of possible value as a guide to therapy in only five and even these were doubtful.

5. In cases of pneumonia in the age group 15-60 without significant coexistent disease, it is felt that routine bacteriological studies are unnecessary.

6. A classification of pneumonias based on the presence of coexistent disease is presented as a guide to treatment and prognosis. It is felt that this will be generally more useful to the clinician than previous classifications based on bacterial etiology.

RESUMEN Y CONCLUSIONES

1. Seiscientos veinticinco casos entre las edades de 15 a 60 años que fueron admitidos con el diagnóstico de neumonía al Hospital General de Rochester, son objeto de un estudio.

2. Se puso especial atención a las enfermedades coexistentes y a los estudios bacteriológicos en relación con la evolución de la enfermedad y el tratamiento recibido.

3. Con el tratamiento antibiótico de rutina la evolución de la enfermedad dependió más de la presencia de enfermedad coexistente que de la virulencia del germen causal.

4. En 340 casos de neumonía sin coexistencia de enfermedades significantes, los estudios bacteriológicos fueron de valor como guía del tratamiento sólo en cinco y aún esos fueron dudosos.

5. En casos de neumonía entre las edades de 15 a 60 sin enfermedades coexistentes de significación se piensa que los exámenes bacteriológicos de rutina son innecesarios.

6. Se presenta una clasificación de las neumonías basada en la presencia de enfermedades coexistentes como guía del tratamiento y del prónóstico.

Se cree que esto será más útil al clínico que las clasificaciones anteriores basadas en la etiología bacteriológica.

RESUME

1. L'auteur passe en revue, dans un groupe d'individus âgés de 15 à 60 ans, 625 cas de pneumonies admis à l'Hôpital Général de Rochester, de 1948 à 1953.

2. Les affections coexistantes, et les recherches bactériologiques, en rapport avec l'évolution de la maladie et la traitement reçu, furent tout spécialement prises en considération.

3. Lorsqu'elle était traitée par les antibiotiques courants, l'évolution de la maladie fut plus influencée par l'existence d'affection surajoutée que par la virulence du microbe en cause.

4. Dans 340 cas de pneumonies sans maladies coexistantes nettes, les études bactériologiques eurent une certaines valeur pour guider le traitement dans cinq cas seulement et encor ceux-ci furent-ils douteux.

5. Pour les pneumonies du groupe de personnes âgés de 15 à 60 ans, et sans affection nette surajoutée, les études bactériologiques courantes se montrèrent inutiles.

6. L'auteur présente une classification des pneumonies basées sur la présence d'affections coexistantes pour établir le traitement et le pronostic. Celle-ci serait généralement plus utile au praticien que les classifications antérieures basées sur l'étiologie bactériologique.

ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNG

1. In der Altersgruppe von 15-60 Jahren wurden 625 Fälle, die mit Pneumonie in das Allgemeine Krankenhaus von Rochester von 1948-1953 eingewiesen worden waren, einer Durchsicht unterzogen.

2. Besondere Aufmerksamkeit wurde Begleitkrankheiten gewidmet wie bakteriologischen Untersuchungen in Bezug auf den Krankheitsverlauf und die durchgeführte Behandlung.

3. Unter planmässiger antibiotischer Behandlung hing der Krankheitsverlauf mehr vom Vorliegen begleitender Krankheiten ab als von der Virulenz des ursächlichen Erregers.

4. Bei 340 Fällen von Pneumoniex ohne bedeutende Begleitkrankheiten waren bakteriologische Untersuchungen von möglichem Wert als Anhalt zur Therapie nur in 5 Fällen, und selbst diese waren zweifelhaft.

5. Bei Fällen von Pneumoniex der Altersklassen zwischen 15 und 60 Jahren ohne bedeutsame Beglietkrankheit werden systematische bakteriologische Untersuchungen für nicht notwendig gehalten.

6. Eine Klassifizierung von Pneumonien, ausgehend vom Vorhandensein von Begleitkrankheiten wird vorgelegt als Anleitung zur Behandlung und Prognosenstellung. Es wird die Auffassung vertreten, dass dies für den Kliniker im Allgemeinen nützlicher sein dürfte als die früheren, von der bakteriologischen Aetiologie ausgehenden Einteilungen.

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Bronchiectasis: Concepts of Therapy

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The gloomy prognosis of bronchiectasis and the early recommendation for surgery are not justified in more than a small percentage of patients.[1] Upon the acceptance or denial of this hypothesis, depends the regime one will propose in the treatment of bronchiectasis.

The natural impulse of anyone, whether patient or physician, is to remove any abnormal condition whenever it is possible. This may be accomplished by medication, surgery, or "tincture of time" as the case may be. Whenever one must resort to "living with his disease" it seems to represent a failure on the part of the physician. Though the operation of lobectomy in recent years has been found to yield the most satisfactory results,[2] a constant reevaluation is necessary to keep pace with the changing picture.

In the lecture-room, the student is impressed with the social implication of this disease. The picture is conjured up of a soiled, bedraggled unfortunate who has been ostracized by his society to a small shack by the city dump. His frequent cough, odoriferous breath, and foul sputum have turned him from family, home, and occupation. He is reduced to the lowest depths. Perhaps this point is stretched to impress the student of the menace of this disease. However, it may be that changes in the years and the therapeutic advances made in that time have altered its severity. Churchill,[3] in 1938 presented a number of bronchiectasis cases and discussed some of their psychologic manifestations. It appeared as though severe adjustment problems were found. Children with the abnormality were stunted in their psychic growth. Marriages were broken, employment difficult to obtain, and suicides more frequent than that found in the general population.

More recently, Wynn-Williams (1952)[1] concluded a five year study of the subject on an unselected group of 214 cases from a typical community in England. He states: "All the children in this series were able to attend school. . . and only five adults (less than 4 per cent) were unable to work or to conduct their household duties." There were no divorces or suicides, social implications were slight, and there seemed to be no undue marital difficulties. His findings are obvious, but a further study of the more metropolitan areas with their "skidrow" and slum districts should be considered for a better overall impression. Can it be that the manifestations have changed, or does early diagnosis now find the less severe and earlier forms before they can develop into the classical picture described 15 years ago? In any event, the psychologic problems connected with bronchiectasis appear to be less frequent now.

Without developing this line of thought any further, let us delve into the diagnosis of this entity. As, in any satisfactory diagnosis, one

should have a good working knowledge of the pathologic processes that cause the symptoms and signs of bronchiectasis. The numerous theories put forth add to the student's confusion and impresses him that the last word in pathogenesis is not yet forthcoming. When Laennec[4] first described bronchiectasis he ascribed the cause to stagnant bronchial secretions. Though he lacked a histological approach, he aptly described the destructive changes of the bronchial walls. However, he indicated the origin of bronchiectasis in the bronchi. Corrigan,[14] propounded the theory that this disease is the result of disease of the lung parenchyma itself with subsequent fibrosis and traction applied to the walls of the bronchi. Other factors have been considered: namely, developmental anomalies, bronchial stenosis, neuromuscular paralysis, and allergy, to name a few.

Whatever one's leaning on the type of etiology, the diagnosis classically depends on this triad—

1. Relevant history of illness from which symptoms started
2. Presence of abnormal physical signs and symptoms
3. A radiological abnormality.[1]

In a recent article, Burnett et al.[5] showed the most common illnesses associated with bronchiectasis were in decreasing order of incidence:

Pneumonias (especially bronchopneumonia)
Pertussis (pneumonia secondarily)
Measles (pneumonia secondarily)
Tracheobronchitis
Influenza
Lung abscess
Foreign body
Tuberculous stenosis
Allergy
Empyema
Tumors
Postoperative aspiration

It is interesting to note, however, that 49 per cent were of unknown etiology wherein the underlying causative illness was never severe enough to prompt the patient to seek medical help or to be remembered. The question of whether or not an illness is the initiating factor is an interesting one. In considering congenital abnormalities in the development of the postnatal lung, Mayer and Rappaport[6] state, "the minor pulmonary defects which persist (past the postnatal period) may become the predisposing factors for development of cystic and bronchiectatic changes by inviting repeated infection acquired in later life."

The most common symptom is a chronic racking cough with purulent sputum found in 85 per cent in one study,[7] also hemoptysis in 47 per cent. Bronchiectasis is said to be the most frequent cause of hemoptysis in children under 16 years of age.

Since the normal cough reflex for removal of particulate matter from the respiratory tree has been destroyed, the accumulation of secretions

during the night typically causes excess coughing and expectoration in the morning. The sputum may be copious and is described as three-layered: frothy on top, greenish and turbid in the middle, and purulent at the bottom.

Paranasal sinusitis has been frequently incriminated as an etiologic agent and therefore used as a corollary symptom of bronchiectasis. The point is raised that this can be a source of pulmonary infection. Much evidence has been accumulated indicating the high incidence between the two.[9] It is more likely that the same etiologic factor that causes the sinusitis simultaneously causes the infection that leads to bronchiectasis in some people. In this sense one might look further for ectasias when sinusitis is discovered but this condition is significant only with other diagnostic criteria.

In decreasing order of frequency the symptoms are:

Chronic, racking cough with purulent, layered sputum
Hemoptysis
Chest pain
Dyspnea
Sinusitis
Invalidism

In general the physical signs elicited are those of a chronic pneumonitis rather than that of dilated bronchi. Clubbing of digits is said to be found frequently in bronchiectasis but one cannot find a direct relation to the extent or duration of disease. *The only physical sign that is said to be typical is persistent moist rales localized to the damaged areas.*

To fulfill the third classical diagnostic point one must observe roentgenograms for minor changes that are significant. They are:

Opacities suggesting pneumonia
Circular or ring shadows
Obvious triangular shadows associated with lobar collapse
Slight lateral shift of heart or mediastinum
Change in positions of hemidiaphragm or tenting
Reduction in size or obliteration of costophrenic angle
Compensatory emphysema
Collapsed segments or subsegments

In Wynn-Williams' study there were 25 per cent that had no symptom and 30 per cent with no constant localizing chest finding, but only 2 per cent had normal postero-anterior roentgenograms.

In addition to the routine posterio-anterior film of the chest, it is essential that visualization of the pulmonary tree be accomplished by a suitable radio-opaque substance. Since the tertiary or smaller bronchi are most frequently involved and are inaccessible to the bronchoscope, the introduction of iodized oil[8] in 1922 was of tremendous value in the diagnosis of bronchiectasis. Since, as noted before, the symptoms have a closer relation to the infection active in the lung than to the actual extent of ectasis, it is extremely important to outline the involved areas

by this method.

It is by this technique that further information of the nature of this disease is presently being revealed. And although newer radio-opaque substances have been developed, iodized oil is still used generally for this purpose, (recently developed water soluble substances "umbrodil" has been linked with possible granuloma formation following its instillation). One might expect that iodized oil is absorbed slowly. Several cases have been noted wherein the media was present up to six months or longer after instillation. Again, one must consider iodine sensitivity, whenever it is used.

With the preceding well in mind, the problem of approaching the necessary therapy should now be considered. The goals should be clearly stated.

1. Relieve the patient of his symptoms.
2. Prevent complications.
3. Prevent spread of disease to other lobes.

In the patients, upon whom surgery is considered feasible, the removal of the involved segments fulfills these goals. Let us consider the results on this carefully selected group of patients.

Simpson,[10] in 1954 reviewed 138 patients who underwent surgery in the previous eight years. There were six deaths and 44 postoperative complications. In a follow-up of those cases at the end of the period there were 86.2 per cent "good to satisfactory" and 13.8 per cent "unsatisfactory" results. He had carefully selected his patients and the following groups were omitted from surgery:

1. Those with minimal symptoms and mild bronchiectasis, whose progress under conservative treatment may be watched.
2. Those with too extensive disease, who, after the removal of the bronchiectatic areas would be left with insufficient lung.
3. Those whose age or general condition contraindicated operation.

Ochsner, et al,[11] had a 3.1 per cent death rate in a series of 92 patients with a 4.2 per cent unsatisfactory result group.

Unfortunately the basis for the "unsatisfactory status" were not brought out. As Wynn-Williams points out, it would be interesting to determine the status of those patients to whom surgery was recommended and refused. Here indeed would be a comparable group to determine the effectiveness of more conservative means of therapy.

These conservative means consist of postural drainage, control of infection by antibiotics, physiotherapy (breathing exercises), bronchoscopy when needed, and measures for general good health.

When one thinks of postural drainage, one frequently has visualized several contortions made by the patient attempting to obtain dependent drainage. However, Kane and Irving[12] have systematically devised a routine of simple positions that are designed to drain the lung from each specific bronchopulmonary segment. These are done with a minimum of uncomfortable movements of the patient and appear quite effective.

Antibiotic control in lung infections is usually good and few people succumb to pneumonia alone today. Deep breathing exercises are of obvious benefit. One may need to resort to bronchoscopy on occasion if the other means are inadequate.

It would appear then that there is little doubt that bronchiectasis can be cured by resection of the diseased segments of the lung. Before recommending surgery, each physician, should carefully weigh the goals and attain them by his best means available.

SUMMARY

The classical impressions of bronchiectasis are reviewed. Stress is placed on the changes in concepts of this disease in recent years. The two major fields of therapy are discussed. Goals of therapy are enumerated and the attempt is made to determine the best way of reaching these goals.

RESUMEN

Se revisan las impresiones clásicas sobre bronquiectasia. Se recalcan los cambios en los conceptos durante los últimos años. Se discuten los dos campos principales de terapia. Los objetivos del tratamiento se enumeran intentando determinar la mejor manera de alcanzarlos.

ZUSAMMENFASSUNG

Die klassischen Merkmale der Bronchiektasie werden einer Besprechung unterzogen. Nachdruck wird auf die Veränderungen in den Auffassungen dieser Krankheit in den letzten Jahren gelegt. Die 2 Hauptgebiete der Therapie werden besprochen. Die Ziele der Therapie werden aufgezählt und der Versuch unternommen, den besten Weg zu bestimmen, um diese Ziele zu erreichen.

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Primary Pulmonary Carcinoma Associated with Active Pulmonary Tuberculosis

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Introduction

The importance of the simultaneous occurrence of primary pulmonary carcinoma and pulmonary tuberculosis has been appreciated relatively recently. Some decades ago the association of the two diseases was thought to be a rarity and the condition was infrequently found even by the pathologist. This gave rise to the assumption that a certain antagonism may exist between carcinoma and tuberculosis. It is, however, reasonable to assume that the rarity of the association of the two diseases in the earlier years was probably due to the fact that tuberculosis was a disease of the young and carcinoma a disease of the older age and the majority of the tuberculous patients died before reaching the so-called cancer age.

In the past few years, however, an increasing number of cases with the two diseases has been reported and this unquestionably has led to a growing interest in this subject.

Fifteen cases of co-existing primary pulmonary carcinoma and active pulmonary tuberculosis are presented. Several others with carcinoma of the lung in which non-tubercle acid fast organisms were demonstrated are not included.

The summaries of the fifteen case histories are as follows:

Case 1: O. P. is a 61 year old male. Five years before admission chest roentgenogram taken because of productive cough was found to show some abnormality in the upper part of the left lung. On admission symptoms were present, and x-ray film revealed a large cavity in the left upper lung field with scattered disease throughout the right lung. Tubercle bacilli were found on smear and culture. On chemotherapy both clinical and radiological improvement occurred, but at nine months a new shadow was noted in the left hilar area and mid lung field (Fig. 1). Bronchoscopic examination revealed a granulating mass in the left main bronchus about 2 cm. below the carina. Biopsy specimen showed anaplastic carcinoma. One month later left thoracotomy was performed and the carcinoma was found inoperable.

Case 2: D. G. is a 43 year old male. In the admission chest roentgenogram a moderately dense, ill-defined infiltration was seen in the left upper lung field. A tuberculin skin test was positive but tubercle bacilli were not demonstrated in the sputum on smear or culture. Bronchoscopy failed to show evidence of tuberculous bronchitis or new growth. Chemotherapy produced considerable clearing of the shadows. Three months later bronchoscopy again failed to show evidence of tuberculosis or tumor. Six months after admission tubercle bacilli were demonstrated in the sputum on smear and culture, and left artificial pneumothorax was induced. This was soon abandoned because of fluid formation and atelectasis of the left upper lobe. Bronchoscopy was repeated in three months and revealed a polypoid mass inside the left upper ostium. Left pneumonectomy was performed. The pathological diagnosis was typical squamous cell carcinoma and tuberculosis.

Case 3: R. G. P. is a 71 year old male. On admission he was complaining of increasing productive cough, wheeze, progressive dyspnoea and loss of weight of one year's duration. X-ray film showed disease in both upper lung fields with a cavity in the right apex. Repeated sputum examinations were positive for tubercle bacilli on smear and culture. On chemotherapy definite clinical and radiological improvement occurred. Seven months after admission he had haemoptyses, and began to have anorexia, loss of weight and tiredness. At the same time a new shadow was noted

in the left hilar area (Fig. 2). Bronchoscopy revealed a granulating mass in the left main bronchus. Biopsy revealed anaplastic carcinoma. This was considered inoperable and he died six months later. Autopsy was performed and a tuberculous cavity measuring 4 cm. in diameter was found in the right apex, fibrocaseous tuberculosis in both upper lungs and carcinoma in the left main bronchus.

Case 4: A. A., a 47 year old male who had periodic x-ray films since 1950 when a shadow was found in the right upper lung field. Three months before admission he began to have productive cough, loss of weight and right chest pain. A roentgenogram showed extension of the disease. The admission roentgenogram revealed a cavity in the right apex with dense shadowing in the right upper and left upper lung fields. Sputum was positive for tubercle bacilli on smear and culture. On chemotherapy his clinical condition deteriorated and an extension of the disease occurred in the x-ray film. Five months after admission he developed massive right pleural effusion and clear fluid was aspirated in which definite malignant cells were demonstrated. He died one month later. At autopsy bilateral far advanced tuberculosis with cavitation in the upper lobes and squamous cell carcinoma arising from the right main bronchus was found. The right pleura was made up almost entirely of tumor tissue.

Case 5: McM. J. is a 35 year old male. Four months before admission he had haemoptyses, productive cough, recurrent left chest pain, and loss of weight. A roentgenogram showed some abnormality in the left upper lung field. On admission the roentgenogram revealed a dense ill-defined shadowing in the same area. Bronchoscopy failed to show evidence of tuberculous bronchitis or tumor. Bronchial secretion was reported positive for tubercle bacilli on culture but repeated sputum examinations failed to demonstrate them on smear or culture. He received chemotherapy with definite improvement by x-ray film and clinical condition. Eight months after admission left artificial pneumothorax failed because of inseparable adhesions. Five months later left thoracoplasty was considered because of persistent suspicious cavity but routine bronchoscopy revealed active tuberculous bronchitis on the left side. Antibiotics were continued. Bronchoscopy four months later with biopsy of the pathology in the left upper lobe bronchus suggested malignancy and showed squamous cell carcinoma. Left thoracotomy was performed but the carcinoma was considered inoperable.

Case 6: M. J. J. is a 53 year old male, who was in a sanatorium as a child. In an industrial survey three years before admission a roentgenogram revealed disease in the apices of both lungs. Four months prior to admission he began to lose weight and had productive cough with occasional blood streaking, and extension of the disease was noted in the roentgenogram. On admission x-ray film of the chest showed soft infiltrations with a cavity measuring 1" in diameter in the right upper lung field and soft infiltrations throughout the left lung with a cavity measuring three-fourths of

FIGURE 1

FIGURE 2

Figure 1 (Case 1): Chest roentgenogram shows a large cavity in the left apex and nodular shadows throughout the right lung. Left hilar area enlarged. Carcinoma in the left main bronchus.—*Figure 2* (Case 3): Chest roentgenogram shows tuberculous disease in both upper lung fields with a cavity in the right apex. Left hilar shadow. Carcinoma in the left main bronchus.

an inch in diameter in the apex and dense shadowing in the hilar area. Sputum was positive for tubercle bacilli on smear and culture. Bronchoscopy revealed a fungating mass in the left main bronchus about 1.5 cm. distal to the carina partially obstructing the lumen. Squamous cell carcinoma was found on biopsy. He died six months later. At autopsy two large tuberculous cavities and scattered fibro-caseous tuberculosis were found in the right lung. A tumour arising from the left main bronchus and fibro-caseous tuberculosis were in the upper lobe of the left lung.

Case 7: Y. K. is a 51 year old male who on admission complained of productive cough, loss of weight, fatigue and right chest pain of four months' duration. In the admission roentgenogram a dense homogeneous, ill-defined shadowing was noted in the right upper lung field. Bronchoscopy failed to show evidence of tuberculous bronchitis or new growth. Sputum was repeatedly reported negative for tubercle bacilli on smear and culture. In two specimens, however, malignant cells were demonstrated. Right pneumonectomy was performed and the specimen contained a large squamous cell carcinoma arising from the apical branch of the right upper lobe bronchus. Large patches of caseous tuberculosis were present at the lower edge of the tumor in which acid fast bacilli were demonstrated.

Case 8: F. G. is a 57 year old male who two years before admission experienced shortness of breath, productive cough, fatigue and sharp pain in the right shoulder. Two months before admission an x-ray film was found abnormal. On admission he was ill and a roentgenogram revealed massive right pleural effusion, large partially calcified shadows in the apex of the right lung and scattered shadows of varying size in the left lung. Sputum was positive for tubercle bacilli on smear and culture. The right chest was aspirated on several occasions and clear straw-coloured fluid was obtained which later became haemorrhagic. The pleural fluid showed occasional acid fast bacilli on direct smear but malignant cells were not demonstrated. He died four months after admission. A large, squamous cell carcinoma arising from the right main bronchus with finger-like extension to the periphery and invasion of the right pleura was found, along with caseous partially calcified tuberculous disease in the right apex. Several tuberculous cavities of varying size were present in the left lung. Acid fast bacilli were demonstrated in the tuberculous lesions.

Case 9: T. B. is a 42 year old male who one year before admission had left pleurisy but was not hospitalized. Three weeks prior to admission he noticed productive cough, loss of weight, fatigue, left chest pain and a roentgenogram was abnormal. On admission he had frank haemoptysis for four days and x-ray film showed heavy confluent soft mottling in the right upper lung field. Sputum was positive for tubercle bacilli on smear and culture. Bronchoscopy two months later revealed a friable cauliflower mass in the ostium of the right upper lobe bronchus. Biopsy revealed squamous cell carcinoma. Right pneumonectomy was performed and carcinoma of the right upper lobe bronchus and active tuberculosis of the right upper lobe were found.

Case 10: McS. C. is a 55 year old female who on admission was complaining of dyspnoea, loss of weight, productive cough of one year's duration, and blood streaked sputum on several occasions. The roentgenogram on admission showed a large cavity in the apex of the right lung, a small one at the inner end of the first rib with patchy infiltrations throughout the right lung. Soft patchy shadows with suspicious cavity were present in the left upper lung field. Acid fast bacilli were demonstrated in the sputum on smear. Right artificial pneumothorax was attempted but was impossible. Her condition failed to improve and increasing dense shadowing appeared in the right hilar area spreading to the mid lung field, in the subsequent x-ray films. Bronchoscopy 10 months later showed no evidence of tuberculous bronchitis or tumor. Her condition rapidly deteriorated and she died a few weeks later. Tuberculous cavities in the right upper lobe and tumor masses in the middle and lower lobes were found. A large number of tuberculous lesions were present in the left lung. Pathological diagnosis was carcinoma and tuberculosis. There was no note as to the type of carcinoma.

Case 11: G. H. is a 48 year old male who five months before admission had a cold with productive cough and later loss of weight and fatigue. X-ray film was abnormal. On admission he was in a rather poor general condition and the roentgenogram revealed a large cavity in the right upper lung with patchy and nodular shadows throughout both lungs. Sputum was positive for tubercle bacilli on smear and culture. On bed rest his condition improved a great deal and subsequent x-ray films showed improvement. Three years after admission the roentgenogram revealed a new shadowing in the right hilar area. Two months later he noticed several lumps in the right side of the neck. His condition began to deteriorate and death occurred four months later. Anaplastic carcinoma was found arising in the right middle lobe bronchus. A tuberculous cavity was present in the right apex and fibro-caseous tuberculosis in both lungs.

Case 12: S. K. is a 55 year old male who two months before admission began to have slight productive cough, tiredness. Abnormality was noted in both upper lung fields in roentgenogram. On admission he was in a good general condition and the roentgenogram revealed a small cavity in the left upper lung field and patchy shadows in both upper lung fields. Sputum was positive for tubercle bacilli on smear and culture. He was given a course of streptomycin and some clearing occurred in both upper lung fields. Eight months later a new shadowing was noted in the roentgenogram, in the right hilar area and mid lung zone. Bronchoscopy revealed active tuberculous bronchitis of the superior branch of the right lower lobe. Another course of streptomyin was given. Subsequent x-ray film however showed a gradual increase of the shadowing in the right mid lung zone and at the same time his clinical condition deteriorated. Repeat bronchoscopy nine months later again showed active tuberculous bronchitis of the superior branch of the right lower lobe and streptomycin was continued. Bronchoscopy was again repeated in three months and granulation tissue was found at the region of the superior branch of the right lower lobe. The biopsy specimen revealed squamous cell carcinoma.

Case 13: S. A. is a 44 year old male who six months before admission had a survey x-ray film which showed patchy and stranded shadows in the right upper lung field and two rounded densities in the left hilar area. At this time he had a cold with slight productive cough. Five months before admission he began to have severe headaches, impaired vision and weakness in the left arm and left leg, and the roentgenogram revealed some increase in the size of the densities in the left hilar region. Bronchoscopy was essentially negative and washing showed no evidence of malignant cells or tubercle bacilli. Because of severe headaches, impaired vision and increased spinal fluid pressure, secondary tumour of the brain was suspected and right sub-temporal decompression was performed with little relief. In the meantime his sputum was reported positive on culture for tubercle bacilli and he was therefore admitted to the Mountain Sanatorium. His condition progressively deteriorated and a few weeks later death occurred. Squamous cell carcinoma was found arising from the superior branch of the left lower lobe and fibro-caseous tuberculosis with a small cavity in the right upper lobe. Acid fast bacilli were demonstrated in the tuberculous lesions. Secondary carcinoma of the right occipital lobe of the brain was present.

Case 14: K. P. is a 52 year old male who about six months before admission noticed fatigue, feverishness with night sweats, slight productive cough, loss of weight and later haemoptysis. A routine industrial x-ray film two months before admission showed some shadow in the lung. On admission to the sanatorium he was ill and the x-ray film revealed nodular and linear shadows in the right upper lung field and a dense, ill-defined shadow in the left hilar area (Fig. 3). Sputum showed tubercle bacilli on

FIGURE 3

FIGURE 4

Figure 3 (Case 14): Chest roentgenogram reveals shadows in the right upper lung field and both hilar areas. Carcinoma was found in the right upper lobe bronchus and not on the left side as it was expected.—*Figure 4* (Case 15): Chest roentgenogram reveals nodular and patchy shadows in the right lung and left lower lung field. Shadows in the right lung represented disease which was partly tuberculosis and partly tumor.

smear and culture. He was given a course of streptomycin, Isoniazid and para-aminosalicylic acid. His clinical condition failed to improve and the x-ray film one month later showed an increase of the shadowing in the right hilar area and right upper lung field. Bronchoscopy revealed a mass originating from the right upper lobe bronchus. Biopsy showed squamous cell carcinoma.

Case 15: K. A. is a 63 year old housewife who in the spring of 1951 developed increasing productive cough with blood streaked sputum on four occasions. She also had persistent dull pain in the left anterior chest, anorexia, loss of weight and fatigue. The daily amount of sputum was rapidly increasing and of whitish colour. In October 1951 the roentgenogram was abnormal but the appearance of the shadows was not typical of tuberculosis and carcinoma of the lung was suspected. The tuberculin test was positive. Sputum showed no tubercle bacilli on direct smear or culture. Bronchoscopy and bronchogram were negative. Malignant cells were not demonstrated in the bronchial secretion. She was under the supervision of the out-patient clinic and six positive acid fast sputum smear reports were obtained and admission to the Mountain Sanatorium was advised. On admission, March 19, 1952 she was complaining of marked productive cough with 1.5 boxes of daily whitish, frothy sputum; wheeze and persistent pain in the left anterior chest, increasing dyspnoea, anorexia and fatigue. The admission roentgenogram showed confluent patchy infiltrations throughout both lungs (Fig. 4). Sputum was positive for tubercle bacilli on smear and culture and two were positive on guinea-pig inoculation. A course of streptomycin and para-aminosalicylic acid was given. However, because of the x-ray film appearance, malignancy was still suspected. One sputum was found suspicious of malignancy. Bronchoscopy was performed on two occasions and failed to show any evidence of tumor. A considerable amount of secretion was seen coming from both sides. Bronchial secretion was slightly suspicious of malignancy. Serial chest roentgenograms showed a gradual extension of shadowing especially on the left side. Clinically she gradually deteriorated, became dyspnoeic and cyanotic and the amount of daily sputum increased to three boxes daily, which was foamy and frothy. She died on March 18, 1953. Fibro-caseous tuberculosis was found in the right lung and alveolar cell carcinoma in both lungs.

Discussion

The chest physician is confronted with many serious difficulties in arriving at an early diagnosis of primary pulmonary carcinoma in patients who are suffering simultaneously from active pulmonary tuberculosis. The clinical picture is usually dominated and the evidences of cancer obscured by the tuberculous disease and there are few reasons for suspecting a second disease. Development of primary pulmonary carcinoma in the presence of known active pulmonary tuberculosis is overlooked in a large number of cases. The roentgenologic appearance of primary pulmonary carcinoma and pulmonary tuberculosis may closely resemble each other and as radiological examination is our most important means for detecting or suspecting pulmonary tuberculosis as well as carcinoma, the difficulties of differentiating the two diseases are obvious.

Since pulmonary tuberculosis is usually treated medically at least at the beginning, whereas pulmonary carcinoma requires early radical surgical treatment, an early and accurate diagnosis is of extreme importance. It should be remembered, however, that the significance of shadows in chest roentgenogram is frequently difficult to evaluate and any radiological evidence of pulmonary lesion establishes no diagnosis. Relatively circumscribed, dense, solid lesions or atelectasis as evidence of bronchial obstruction or the presence or appearance of infiltrating hilar shadows in a patient, past middle age, even with known tuberculosis should be viewed with suspicion and should necessitate further study and examination. It may also be stated that cancer of the bronchus does not show directly on the x-ray film until it is in an advanced stage.

It is not infrequently seen that when the radiological appearance of pulmonary lesions are suggestive of tuberculosis only, clinical study is concentrated on tuberculosis alone for too long a period. It should be kept in mind, however, that even when repeated examinations of the sputum show presence of tubercle bacilli in men past middle age an associated bronchogenic carcinoma may still be a possibility. The incidence of the association of carcinoma of the lung with pulmonary tuberculosis is approximately eight to 10 per cent.[2] It is also true on the other hand that the demonstrating of acid fast bacilli on smear is not adequate for diagnosing tuberculosis in a patient with a lesion in the lung.

We have analysed all the data of our 15 patients as to their value in arriving at an early diagnosis of primary pulmonary carcinoma in tuberculous patients. All but two were men. Their age ranged between 35 and 71, at the time of admission to the Mountain Sanatorium. The highest incidence as expected was found in the fifth and sixth decade. Six were heavy smokers, six moderate, two light smokers and one a non-smoker.

Localized wheeze was present in nine cases at the time the diagnosis of co-existing carcinoma was made. In all five in whom localized wheeze was absent the carcinoma was located in the upper lobe bronchus or in the superior branch of the lower lobe bronchus. It is a common experience that localized wheeze is more common among those with carcinoma of the main bronchus and almost all in this group had this symptom.

Reduction of breath sounds and localized rhonchi were mentioned only in two which seems to reflect our decreasing interest in careful physical examination.

Dyspnoea of various degrees was present in 11 and as could be expected this symptom usually occurred in those in whom the main bronchus was involved and pulmonary tuberculosis was extensive. It should, however, be remembered that dyspnoea out of proportion to the extent of the lesion in the lung should draw attention to the possible presence of bronchial pathology.

Haemoptysis was a fairly common symptom. In nine of the 15 patients haemoptysis was associated with coughing. This varied from streaking to expectoration of large amounts of blood. Four had frank haemoptysis and only two of them had demonstrable tuberculous cavity in the x-ray films. Four had blood streaking and two tuberculous cavity. It is difficult to say what the source of haemoptysis is in patients affected with both tuberculosis and carcinoma. Massive hemorrhage is said to be more common in tuberculosis than in carcinoma of the lung.[4]

Chest pain occurred in 11. There was no note as to the quality of the pain. Sharp pleuritic pain is usually a symptom of tuberculosis, but it might also occur in neoplasm when the pleura is invaded. One (case three) had constant dull ache deep in the left anterior chest in whom carcinoma of the left main bronchus was found. In all probability pain was a result of pressure on the bronchial wall by the tumor mass.

Sputum contained tubercle bacilli in all but one. In 13 sputum was

positive for tubercle bacilli on culture and in one on direct smear only. Only one patient's sputum failed to show acid fast bacilli, but in the surgical specimen caseous tuberculosis was found in addition to carcinoma. In seven the sputum was examined for tumor cells and in four instances the sputum showed the presence of malignant cells. In case 7 with right apical lesions, a positive diagnosis of malignancy was made on the ground of a positive sputum only as bronchoscopy failed to reveal pathology. Cytological examination of sputum is a valuable procedure in accelerating the diagnosis in incipient and peripheral lesions. Its overall accuracy is placed at 80 to 90 per cent.[3] Because of its relative simplicity it could be applied as a screening device in every suspected case, just as a search for tubercle bacilli in the sputum is made in all cases under suspicion of pulmonary tuberculosis.

Bronchoscopic examination was performed in 12 of this series. Two with pleural effusion were too sick and in one malignancy was not suspected and the spreading of the pulmonary disease was thought to be of tuberculous origin. In four bronchoscopy showed no evidence of new growth as the lesions were beyond bronchoscopic reach. In eight diagnosis of malignancy was established by bronchoscopy and biopsy. This shows that bronchoscopy is only second to the roentgenogram in importance in yielding information which is helpful in arriving at a definite diagnosis. In fact a positive diagnosis of carcinoma of the lung can only be made in most cases by microscopic examination of the biopsy specimen or bronchial secretion obtained by bronchoscopy. Bronchial secretion was examined in 10 and malignant cells were found in five cases.

Diagnosis of malignancy was established in four at autopsy, in one by positive pleural fluid for tumor cells, in two by tumor cells in sputum and in eight by bronchoscopy and biopsy.

In this series the right side was somewhat more frequently involved than the left. In eight carcinoma was found in the right lung and in six in the left. The location according to the bronchus was as follows: Right main bronchus two, right upper lobe bronchus three, right lower lobe one, middle lobe two, left main bronchus three, left upper lobe two, and one left lower lobe. Squamous cell carcinoma was found in 10, anoplastic carcinoma in three and alveolar carcinoma in one. In one case there was no note on the type of cancer.

Pleural effusion may be present in a significant number of cases of primary pulmonary carcinoma as well as of pulmonary tuberculosis. Two of our patients developed massive right pleural effusion. In one the aspirated fluid was cloudy, not haemorrhagic and malignant cells were found but no acid fast bacilli could be demonstrated on smear and culture. In the other the fluid was haemorrhagic and acid fast bacilli were found on smear on one occasion but no malignant cell was seen on repeated examinations. In both cases the effusion was of neoplastic origin as proved by autopsy. It is worthy of note that in both the carcinoma was located in the right main bronchus and far advanced cavitary pulmonary tuberculosis was present.

In 12 in this series tuberculosis was present on the same side of the lung where carcinoma has developed. In eight tuberculosis was unilateral and in five both diseases were on the same side. In six pulmonary tuberculosis was bilateral, cavitary and rather extensive. The two diseases seemed to arise in different areas of the lung. They were, however, found frequently adjacent to each other or intermingled with each other as a result of invasion of the tuberculous areas by the malignant cells. It appears therefore not unreasonable to assume that in cases two, seven and nine, in which tuberculosis and carcinoma have occurred in the same lobe, that the neoplastic cells might have invaded the encapsulated tuberculous caseous foci destroying it and liberating the encased living tubercle bacilli. This might have led to the appearance of tubercle bacilli in the sputum and reactivation of the tuberculous disease.

The problem as to the possible etiologic relationship between pulmonary tuberculosis and carcinoma of the lung is still controversial. Some writers believe tuberculosis plays no significant role in the production of pulmonary carcinoma. Others say that the association of active pulmonary tuberculosis and carcinoma of the lung may be only coincidental but the same does not hold with regard to "healed" tuberculosis. Several cases of carcinoma of the lung arising in tuberculous cavity or in tuberculosis scar tissue have been reported. More recently the significance of a close association between carcinoma of the lung and calcified foci in the lung or tracheobronchial lymph nodes has been emphasized. It is believed that a calcified focus or "healed" tuberculous scar may mark an area of the lung particularly susceptible to the development of carcinoma. The principal factor is said to be the metaplasia of the bronchial mucosa as a result of chronic irritation.[5] In two of our patients the diagnosis of tuberculous bronchitis was made in the same area of the bronchial tree where carcinoma was found later. In these cases the possibility must be taken into consideration that the pathology in the bronchial tree seen on first examination by the bronchoscopist was not tuberculosis but malignant. This demonstrates the importance of biopsy in every bronchial lesion. Whether healing or healed tuberculous bronchitis may or may not predispose to the development of bronchogenic carcinoma is of course a matter of speculation.

Thoracotomy was performed in five. Two were found inoperable and in three pneumonectomy was done. One refused thoracotomy. In all three cases of pneumonectomy both tuberculosis and carcinoma were located in the same lung and the contra-lateral lung was free of tuberculous disease. It appears to be important to establish an early diagnosis of lung cancer in a stage of operability even in tuberculous patients as radical surgery gives some hope for survival and pulmonary resection is also practised in pulmonary tuberculosis. In the majority of our cases there were certain features present on admission or they developed during stay in the sanatorium which have called our attention to the possible presence of lung carcinoma and made us carry out further investigation. A short summary of these features as they were observed in our series follows:

1. The atypical appearance of the lesions not entirely characteristic of tuberculosis in the roentgenogram.

2. Failure of clinical and radiological improvement while on chemotherapy.

3. Clinical and radiological deterioration while on chemotherapy.

4. The apearance of hilar shadows while simultaneous clearing occurred in other areas of the lung. This was the most common observation.

It is well known that the peak of tuberculosis morbidity and mortality was already moving into the older age groups in the pre-antibiotic era. With the advent of antibiotic drugs tuberculosis mortality has decreased and life expectancy of tuberculous patients increased to such an extent that the majority of tuberculous patients are now reaching an older age in which pulmonary carcinoma is most likely to occur. It is our experience that the number of older patients with active pulmonary tuberculosis admitted to the Mountain Sanatorium is steadily increasing.

It can also be stated with certainty that primary pulmonary carcinoma which was considered a rarity two decades ago has become one of the most frequent and important primary malignant lesions and the incidence is undoubtedly increasing. As the diagnostic acumen of the clinician today is steadily increasing it is reasonable to assume that a higher percentage of primary pulmonary carcinoma will be diagnosed ante mortem.

There are therefore good reasons for believing that we may well expect to encounter the association of active pulmonary tuberculosis and primary pulmonary carcinoma with greater frequency in the future and the early detection of carcinoma of the lung will present clinical problems of utmost importance to every physician treating tuberculous patients in older age groups.

Acknowledgements: I am indebted to Dr. H. T. Ewart, Medical Superintendent, and the Members of the Staff at the Mountain Sanatorium, Hamilton, Ontario, for their helpful criticism.

SUMMARY

1. Fifteen patients with association of active pulmonary tuberculosis and primary pulmonary carcinoma are presented. The difficulties of differentiating the two diseases are discussed.

2. All data are analysed as to their value in arriving at an early diagnosis, of primary pulmonary carcinoma in patients with active pulmonary tuberculosis.

3. Some features which led to suspecting pulmonary carcinoma in the presence of active pulmonary tuberculosis such as atypical x-ray appearance, failure of clinical and radiological improvement on antibiotic treatment and the appearance of hilar shadows are described.

RESUMEN

1. Se presentan quince enfermos en los que se asociaron tuberculosis pulmonar y carcinoma primario pulmonar. Se discuten las dificultades para diferenciar las dos enfermedades.

2. Se hace un análisis de todos los elementos en cuanto a su valor para llegar a un diagnóstico pronto de carcinoma pulmonar en enfermos con tuberculosis pulmonar activa.

3. Se describen algunas características que conducen a sospechar el carcinoma pulmonar en presencia de la tuberculosis pulmonar activa tales como aspectos atípicos a los rayos X, falta de mejoría clínica y radiológica bajo la influencia de los antibióticos así como también se describe la apariencia de las sombras hiliares.

RESUME

1. L'auteur présente 52 malades porteurs de tuberculose pulmonaire active associée à un cancer pulmonaire primitif. Il discute les difficultés de différencier les deux affections.

2. Il analyse la signification de toutes les constatations qui permettent le diagnostic précoce de cancer primitif chez des malades porteurs de tuberculose pulmonaire active.

3. Il décrit quelques éléments caractéristiques qui l'amenèrent à suspecter l'existence d'un cancer pulmonaire en même temps que la tuberculose pulmonaire active, tels que l'aspect radiologique, l'absence d'amélioration clinique et radiologique au cours du traitement antibiotique, et l'aspect des ombres hilaires.

ZUSAMMENFASSUNG

1. Vorstellung von 15 Kranken, bie denen aktive Lungentuberkulose und primärer Lungenkrebs miteinander vergesellschaftet waren. Die Schwierigkeiten der Differenzierung der 2 Krankheiten werden besprochen.

2. Alle Daten werden analysiert hinsichtlich ihres Wertes, um zu einer Frühdiagnose zu gelangen bei primärem Lungenkrebs bei Kranken mit acktiver Lungentuberkulose.

3. Beschreibung einiger charakteristischer Merkmale, die dazu Anlass geben, einen Lungenkrebs beim Vorliegen aktiver Lungentuberkulose zu vermuten, wie atypisches röntgenologisches Aussehen, Ausbleiben klinischer und radiologischer Besserung auf antibiotische Behandlung und das Auftreten von Hilusschatten.

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Tuberculosis Case Finding in Hospital Admissions

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The value of the x-ray film survey in tuberculosis case finding has been corroborated by many studies during the past 30 years. In numerous surveys emphasis has been placed on age, sex, race, occupation, economic status etc.; other studies have shown that there is a high yield of unsuspected active pulmonary tuberculosis in admissions to general hospitals. It is the purpose of this paper to direct attention to adult admissions to general hospitals as a special population group in which the incidence of unsuspected active pulmonary tuberculosis is still relatively high and to suggest control measures.

Bryant[1] summarized findings in six surveys of hospital admissions which were published from 1935 to 1945. In only two of these studies were the x-ray film findings verified by clinical and laboratory evidence. Childress et al[2] found the prevalence of unsuspected active pulmonary tuberculosis was six per 1000 among 7,187 admissions to Grasslands Hospital from July 1, 1941 to January 1, 1943. Epstein and Meliss[3] similarly found that the incidence of unsuspected active pulmonary tuberculosis was six per 1000 among 3,487 hospital admissions to the Flushing Hospital from August 1944 to July 1945.

In the remaining four surveys, the findings were based on the x-ray film interpretation of the initial screening film. These reports need verification by follow-up examinations, laboratory and clinical study. The purpose of the x-ray film phase of the survey is to discover unsuspected, previously unknown cases of pulmonary tuberculosis. But the x-ray film by itself although important has its limitations in case-finding and in epidemiological studies. Garland and Cochrane[4] have shown that opinions of radiologists and chest specialists vary considerably in their interpretation irrespective of the size of the film. There is disagreement with each other and with themselves to a significant degree on rereading of such films. Errors in interpretation based on films called "positive" was 30 per cent in certain studies. In the present study, results of clinical follow-up examinations of 265 persons suspected of tuberculosis revealed that 84 (32 per cent) were negative. In the New York State Department of Health, Hospital Program,[5] results of clinical follow-up examinations of 4,983 persons suspected of tuberculosis revealed that 1,557 (31 per cent) were negative. It is obviously essential that the chest x-ray film survey be combined with an effective verification and clinical follow-up program. Every tuberculosis suspect picked up on the original x-ray film survey must be thoroughly studied to determine the presence of tuberculous infection and the state of activity. Our study has demonstrated the effectiveness of this method in adult admissions to general hospitals.

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Unrecognized tuberculosis in the general hospital is a problem which can be solved by the tuberculosis case finding program. This has been found productive and of epidemiological value. In addition to the discovery of previously unsuspected tuberculosis, case finding in hospital admissions has been valuable in directing attention to the older age group as most significant both as sources of infection and as victims of the disease. It is hoped that greater familiarity with the results of tuberculosis case finding in adult admissions to general hospitals will result in the adoption of survey programs in all general hospitals. Other biproducts of the hospital tuberculosis case finding program are lung tumor suspects, abnormal cardiac shadows and rare chest lesions.

During the past decade the tuberculosis case finding survey program has been standardized so that the data obtained is not based on impressions of the "screening" x-ray film alone but also by verification in each instance by follow-up x-ray films, laboratory and clinical evidence. A survey program suitable for a general hospital consists of a 70 mm. or 4 x 5 survey chest film on all admissions followed by 14 x 17 film of all tuberculosis suspects. These procedures are usually completed within 48 hours after admission to the hospital. Since all of these tuberculosis suspects are hospital patients, they are available for clinical and laboratory study to establish a diagnosis of the radiographic density in the lung while they are receiving treatment for the primary condition for which they are hospitalized. These studies include tuberculin testing, serial x-ray films and bacteriological studies of sputa and gastric contents which are usually well advanced or completed before the patient is discharged from the hospital. Those with active pulmonary tuberculosis are transferred to the tuberculosis ward for intensive treatment. Patients with inactive tuberculosis are referred to the health department for follow-up care. In these studies an active case is defined as one having positive bacterial findings or x-ray films and clinical evidence of unstable or progressive disease. The yield is measured only in terms of new cases of active pulmonary tuberculosis discovered.

This study is concerned with the incidence of tuberculosis in 10,000 consecutive hospital admissions based on the tuberculosis case finding survey program[5] in operation at the Veterans Administration Hospital, Bronx, N. Y., which is identical with the program followed at all Veteran Administration hospitals since October 1949. All new hospital admissions from October 1, 1953, to February 15, 1955, were included. No person with known pulmonary disease or with pulmonary symptoms was included in this survey. There were 8,494 (85 per cent) white, 1,492 (15 per cent) Negro and 15 of the yellow race. All were men. The 10,000 consecutive hospital admissions have the following characteristics in common. They were all veterans from the low and lower-middle income brackets from the metropolitan New York area. They were all sick with some other primary condition and therefore possibly debilitated to various degrees.

On the basis of the initial 70 mm. screening chest film there were 265 (26.5 per 1000) tuberculosis suspects. Table I shows the distribution

TABLE I
INCIDENCE OF SUSPECTED TUBERCULOSIS BY MASS X-RAY FILM SURVEY. "SCREENING," ACCORDING TO AGE AND RACE IN 10,000 CONSECUTIVE HOSPITAL MEN ADMISSIONS

				WHITE			NEGRO		
	Total	TB Suspects	No. Per 1,000	Total	TB Suspects	No. Per 1,000	Total	TB Suspects	No. Per 1,000
Age	10,000	265*	26.5	8,494	221	26.0	1,492	42	28.2
20 - 29	1,960	27	13.8	1,608	22	13.0	348	5	14.4
30 - 39	2,712	48	17.7	2,170	35	16.1	532	12	22.6
40 - 49	1,662	37	22.3	1,406	32	22.8	256	4	15.6
50 - 59	1,476	69	46.8	1,314	59	44.9	162	10	61.7
Over 60	2,190	84	38.4	1,996	73	36.6	194	11	56.7

*2 suspected tuberculosis in yellow race

according to age and race. The incidence of suspected tuberculosis was 26.0 per 1000 among whites and 28.2 per 1000 among the Negroes. This slightly higher incidence among the Negroes was noted in all the age groups with the exception of those from 40 to 49 years. The incidence of suspected tuberculosis was found to increase progressively with age in both the white and Negro race. It was lowest from 20 to 29 and highest from 50 to 59 years. The next highest incidence of suspected tuberculosis was found in those over 60.

To verify the screening results, those with suspected tuberculosis were subjected to follow-up 14 x 17 chest x-ray films, clinical and laboratory studies. Four suspects in this survey were dropped because of inadequate follow-up. Table II shows that the incidence of tuberculous lesions considered significant on follow-up 14 x 17 chest x-ray now becomes 18.1 per 1000. It also shows the distribution according to age and race. Among the white, the incidence of significant tuberculous lesions was 17.8 per 1000 and among the Negro 18.8 per 1000. The incidence was found to increase progressively with age in both the white and Negro race and was found

TABLE II
INCIDENCE OF TUBERCULOUS LESIONS CONSIDERED SIGNIFICANT ON FOLLOW-UP 14x17 CHEST X-RAY FILM, ACCORDING TO AGE AND RACE IN 10,000 CONSECUTIVE HOSPITAL MEN ADMISSIONS

				WHITE			NEGRO		
	Total	TB Lesions	No. Per 1,000	Total	TB Lesions	No. Per 1,000	Total	TB Lesions	No. Per 1,000
Age	10,000	181*	18.1	8,494	151	17.8	1,492	28	18.8
20 - 29	1,960	12	6.1	1,608	9	5.6	348	3	8.9
30 - 39	2,712	33	12.1	2,170	25	11.5	532	8	15.0
40 - 49	1,662	21	12.6	1,406	19	13.5	256	2	7.8
50 - 59	1,476	51	34.5	1,314	44	33.4	162	7	43.2
Over 60	2,190	62	28.3	1,996	54	27.1	194	8	41.2

*2 tuberculous lesions in yellow race

TABLE III
INCIDENCE OF ACTIVE TUBERCULOSIS VERIFIED BY FOLLOW-UP 14x17 CHEST X-RAY FILM, CLINICAL AND LABORATORY STUDY ACCORDING TO AGE AND RACE IN 10,000 CONSECUTIVE HOSPITAL MEN ADMISSIONS

				WHITE			NEGRO		
	Total	TB Active	No. Per 1,000	Total	TB Active	No. Per 1,000	Total	TB Active	No. Per 1,000
Age	10,000	68*	6.8	8,494	45	5.3	1,492	21	14.1
20 - 29	1,960	9	4.6	1,608	7	4.3	348	2	5.7
30 - 39	2,712	17	6.3	2,170	9	4.1	532	8	15.0
40 - 49	1,662	10	6.0	1,406	8	5.7	256	2	7.8
50 - 59	1,476	10	6.8	1,314	7	5.3	162	3	18.5
Over 60	2,190	20	9.1	1,996	14	7.0	194	6	30.9

*2 active tuberculosis in yellow race.

slightly higher among the Negro in all age groups. It was the lowest in the 20 to 29 and highest in the 50 to 59 group. Table III shows that the incidence of active pulmonary tuberculosis verified by follow-up 14 x 17 chest x-ray film, clinical and laboratory study was 6.8 per 1000. Among the whites it was 5.3 per 1000 and among the Negro 14.1 per 1000. This higher incidence among Negroes was noted in all groups. In from 50-59 years, the incidence was 5.3 per 1000 among whites but 18.5 per 1000 among Negroes, whereas in those over 60, the incidence was 7 per 1000 among the whites but 30.9 per 1000 among the Negroes. It is of epidemiological significance that the highest incidence of active pulmonary tuberculosis again occurs after the age of 50 and that it is three and one-half to four and one-half times as frequent in Negroes as in the whites.

Comment

Schneider and Robins[6] reported the tuberculosis case finding program in the Veterans Administration from October 1, 1949 to April 1, 1951. There were 482,120 hospital admissions (in-patients) with an incidence of unsuspected active pulmonary tuberculosis of eight per 1000 verified by follow-up, x-ray film, laboratory and clinical evidence.

Jacobson and Adler[7] reported results of the tuberculosis case finding program at the Los Angeles County Hospital from November 1, 1951 to October 31, 1952. There were 34,040 hospital admissions with an incidence of previously unknown active pulmonary tuberculosis of six per 1000 verified by follow-up examinations, laboratory and clinical evidence.

Siegal at al[8] reported the results of the tuberculosis case finding program in 71 general hospitals in upstate New York where 1,076,506 persons were examined with an incidence of unsuspected active pulmonary tuberculosis of 1.7 per 1000 verified by follow-up examinations, laboratory and clinical evidence. This low yield cannot be compared with the results in other surveys of hospital admissions because the total persons included in the upstate New York survey was diluted by "new outpatients also," a high percentage of younger age group and 66 per cent women. Comparable

figures however, may be obtained if the total men admissions in their hospital program are tabulated separately. They reported 352,067 men with an incidence of unsuspected active pulmonary tuberculosis of four per 1000 verified by follow-up examinations, laboratory and clinical evidence.*

A summary of the findings in the surveys which were published from 1941 to 1955 indicates that the yield of unsuspected active pulmonary tuberculosis among hospital admission is between six and eight per 1000. This correlates well with the registration of new cases which likewise has changed little during the past 15 years. These findings indicate that control measures may be concentrated advantageously on this special population group of adult hospital admissions. While the epidemiology of tuberculosis may be studied on the basis of mortality rates or prevalence of infection known to health departments the x-ray film survey combined with an effective clinical program must become basic to the solution of the problem. This and similar studies have demonstrated the value of the method in hospital admissions.

A recent trend of importance is the shift in mortality to the older age group, with an elimination of the peak in early adult life. The real significance of this shift in age distribution lies in the increasing importance of the older age group as a source of infection for the younger generation. Furthermore, the majority of the tuberculosis control activities in the past have been focused on the clinical phase of the disease. Widening the focus to include early pathology by means of the x-ray film survey and effective clinical follow-up offers epidemiological promise.

Another recent change of unknown consequence is the shift in the treatment of pulmonary tuberculosis away from the hospital to the clinic and the home. The wisdom of this shift has been questioned by many but for the present, there should be closer public health supervision of the registered case in order to prevent spread of infection within the family and in the community.

Recent reports indicate a marked fall in the infection rates as revealed by tuberculin tests. This together with the sharp decline in the death rate to 12.6 per 100,000 in 1953, may be interpreted, at least in part, as evidence of a decrease in the number of active cases of pulmonary tuberculosis in the community which should therefore reduce the chances of passing the disease to the non-infected.

The results of our study and the experience reported in the recent literature have demonstrated the value of tuberculosis case finding in adult admissions to general hospitals. The voluntary agencies have supported this program for several years. The non-profit private hospitals cannot afford to do these surveys because of the capital investment costs,

*The total men admissions in the hospital program is given in their Table II as 352,067 with an incidence of probably active of 5.2 per 1000 and after follow-up 63.8 per cent of these were active (1168). The incidence of probably inactive was 11.3 per 1000 and after follow-up 6.2 per cent of these were active (248). On this basis, the incidence of unsuspected active pulmonary tuberculosis is calculated as four per 1000.

the expense of current operations and the difficulties encountered in follow-up work. Since this is a serious public health problem, it would appear that this type of program should provide a fertile field for local health and hospital authorities both public and voluntary. In upstate New York,[8] exclusive of New York City, there is a state-wide program for admission chest x-ray films to all general hospitals.

The chest x-ray film survey of the ambulatory population (general population survey) is quite another facet of this problem which requires further study.

SUMMARY AND CONCLUSIONS

There is a significant reservoir of active pulmonary tuberculosis among adult men admissions to general hospitals. The tuberculosis case finding survey program as outlined in this paper, is productive and of epidemiological value.

This survey of 10,000 consecutive hospital men admissions with 98.5 per cent clinical follow-up examinations revealed 68 persons (6.8 per 1000) with unsuspected active pulmonary tuberculosis. The highest incidence of previously unknown cases of active pulmonary tuberculosis occurred after the age of 50 and was three and one-half to four and one-half times as frequent in Negro as in white men, depending upon the age group.

The yield of new cases, based on verification in each instance is as high today as it was 15 years ago. Since this is a serious public health problem, it would appear that this type of program should provide a fertile field for local health and hospital authorities both public and voluntary.

RESUMEN

Hay un contingente significativo de tuberculosis pulmonar activa entre las admisiones de hombres adultos a los hospitales generales. El programa de búsqueda de casos de tuberculosis da resultados y es de valor epidemiológico.

Esta encuesta de 10,000 admisiones consecutivas masculinas a hospitales, el 98.5 de los cuales fueron seguidos con exámenes clínicos, reveló 68 personas (6.8%) con tuberculosis pulmonar activa no sospechada. La frecuencia más alta de casos previamente ignorados de tuberculosis pulmonar activa ocurrió después de la edad de 50 y fué de tres y medio a cuatro y medio veces más frecuente en negros que en blancos.

La obtención de nuevos casos, basada en la verificación de cada circunstancia, es tan alta hoy en día como lo era hace quince años. Ya que éste es un problema de salud pública importante, debe ser aparente que este tipo de programa debe dotar de un campo fértil para las autoridades tanto sanitarias locales, como de hospital ya sean públicas o privadas.

RESUME

Les adultes admis dans les hôpitaux reprèsentent un réservoir très important de tuberculose pulmonaire active. Le dépistage systématique de la tuberculose s'y montre efficace, et il est valable au point de vue de l'étude épidémiologique.

Sur 10.000 admissions consécutives à l'Hôpital, 98,5% des malades

purent être l'objet d'un examen clinique complet. Cet examen révéla que 68 personnes (6,8 pour mille) étaient atteintes de tuberculose pulmonaire évolutive insoupçonnée. La plus forte proportion des cas de tuberculose pulmonaire jusqu'alors inconnus, fut constatée chez les malades âgés de plus de 50 ans, et fut trois fois et demi à quatre fois et demi plus importante chez les noirs que chez les blancs.

La fréquence de nouveaux cas, découverts à l'examen systématique, si l'on se base sur différents exemples, est aussi grande aujourd'hui qu'elle l'était il y a quinze ans. Comme ce fait constitue un problème sérieux de santé publique, il semble qu'un programme de ce genre devrait fournir un champ fertile d'investigation aux autorités locales s'occupant des problèmes sanitaires et des problèmes hospitaliers aussi bien dans le domaine public que dans le privé.

ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

Bei erwachsenen Krankenhauspatienten kommen gar nicht so selten aktive Lungentuberkulosen vor. Die Feststellung dieser Tuberkulosefälle ist produktiv und von epidemiologischem Wert.

Die Übersicht über 10.000 nicht ausgewählte Krankenhauspatienten, von denen 98,5% laufend klinisch untersucht wurden, ergab bei 68 Personen (= 6,8%) eine bisher unerkannte aktive Lungentuberkulose. Am häufigsten wurde eine früher unerkannte aktive Lungentuberkulose bei Patienten in einem Alter von über 50 Jahren gefunden, und zwar dreieinhalb- bis viereinhalbmal häufiger bei Negern als bei Weissen.

Die Ausbeute an neuen Fällen mit gesicherter Diagnose in jedem einzelnen Falle ist heute ebenso gross wie vor 15 Jahren. Nachdem dieses Problem für die öffentliche Gesundheitspflege akut geworden ist, können sowohl die örtlichen Gesundheitsämter als auch staatliche und private Krankenanstalten auf diesem Gebiet ein fruchtbares Betätigungsfeld finden.

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Tracheal Fenestration*

Experimental Aspect

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Tracheal fenestration is defined as the surgical creation of an opening in the cervical trachea provided with door-like skin valves. The skin valves are made so as to close over the tracheal opening. The valves must be held apart to gain access to this opening. This procedure offers an easy entrance into the tracheobronchial tree, which can be kept open or closed at will.

In the following we are reporting the method of tracheal fenestration on dogs. We were prompted to do these experiments by the belief that there was a long felt need for an easy route for suctioning and medicating the bronchial tree in a variety of otherwise nonmanageable, chronic diseases involving the lungs and bronchi.

The surgical technic of the fenestration was worked out by one of us (E. E. R.). These experiments began in December, 1954. A total of 34 operations were performed on 18 dogs. Twenty of these operations on 11 dogs were required to arrive at the present method which was performed for the first time on the 17th of June, 1955.

A step-by-step description of the operation (Operation No. 4) is as follows. A five inch long transverse incision is made over the anterior aspect of the lower third of the neck. The incision is extended in such a way that one skin flap is outlined above and one below the level of the initial transverse incision. These skin flaps extend about one inch in a transverse direction beyond the midline (Fig. 1). Through the original transverse incision, the platysma is incised in a transverse direction to about an inch distant to the right and left of the midline. The trachea is then exposed by splitting the strap muscles. A 1¼ cm. length of two neighboring tracheal cartilages are excised with the underlying mucosa. The newly created tracheal window edges are covered with inverted full thickness skin. On the right and left sides of the window, this is accomplished by inverting the distal margin of each of the skin flaps and fixing them to the tracheal mucosa with interrupted figure 8 sutures of 0 silk. The upper and lower margins of the tracheal window are covered by inverting the angle of the triangular skin surface above and below also with figure 8 sutures of 0 silk. The skin flaps are doubled without dissecting them from

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the underlying subcutaneous tissue layer. The approximated edges of the flaps are kept together with interrupted 000 silk sutures forming a skin valve on the right and left sides of the tracheal window (Fig. 2). In order to bring these valves into an opposing position, on 0 silk through and through mattress suture is placed near the upper and lower margins of the base of the valves, going from right to left and vice versa.

FIG. 1

FIG. 2

FIG. 3

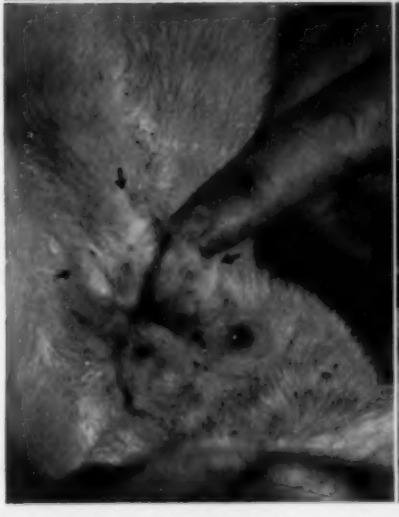

FIG. 4

Figure 1: Shows the skin incision with the skin flaps already outlined.—*Figure 2:* Shows the completed operation with the arrows directed towards the opposing skin valves.—*Figure 3:* Represents a fenestration 41 days after the operation and shows the skin valves in a relaxed position and covering the tracheal window. Arrows and finger point to the valves.—*Figure 4:* Demonstrates the fenestration with the valves stretched, displaying the skin lined tract leading to the tracheal window.

Fourteen operations of this type were performed on 14 dogs. Seven dogs were operated for the first time. They are all alive and the fenestrations are in good condition. The remaining seven dogs were operated one to four times prior to carrying out the final type of operation. Four of these dogs are alive with the fenestrations in good condition. Three died with signs of respiratory difficulties caused by softening of a long segment of the cervical trachea by the fenestrations created at each operation.

To record our experiences with the type of operation which led to the final method described above, we present them in chronological order.

Operation 1: Through a transverse cervical incision two opposing full thickness skin flaps were developed. The cervical trachea was exposed by cutting through the platysma and splitting the strap muscles in the midline. One and one-fourth cm. length of two neighboring tracheal cartilages were removed by subperichondreal method. The underlying tracheal mucosa was split longitudinally and two opposing mucosal flaps developed. Each of these mucosal flaps was sutured to the corresponding skin flap with interrupted 000 silk. The mucocutaneous flaps were doubled and their edges approximated with 000 silk interrupted sutures.

Nine operations of this type were performed on six dogs. This procedure did not work out because within 24 hours the flaps tore apart at the mucocutaneous junction and later the skin flaps became nonviable.

Operation 2: This operation was similar to 1 with the exception that the one and one-fourth cm. length of the two neighboring tracheal cartilages were excised with the underlying mucosa and the opposing full thickness skin flaps were inverted into the lumen of the trachea through the window and sutured to the tracheal mucosa at that level.

The four operations of this type performed on four dogs failed because the skin flaps did not remain viable.

Operation 3: This operation was performed in three stages. First, a transverse skin flap was outlined by a horizontal "U" shaped incision going through the entire thickness of the skin. The skin edges then were approximated with 000 interrupted sutures. After 14 days elapsed, the same skin flap was outlined again. The flap was dissected from its underlying tissue layer and doubled. The edges of the doubled skin flap were approximated with interrupted 000 silk sutures. After an additional 14 days, the underlying cervical trachea was exposed, and a one and one-fourth cm. length of two neighboring cartilages with the underlying mucosa were excised. The free edge of the doubled skin flap was inserted into the trachea through the window and sutured to the inner surface of the tracheal window edge.

Seven operations of this type were performed on seven dogs. Of these, only one led to a successful fenestration with one door-like skin valve on it. The cause of the failure was that these skin flaps became at least partly nonviable.

Twenty operations, as described above (1, 2 and 3), were performed on 11 dogs. Five of them are alive. One had "Operation 3" performed with successful fenestration. Four were reoperated again and are listed among the successful "Operation 4" fenestrations. The remaining six are dead. Three of these were listed among the dead on which "Operation 4" as a repeat procedure was performed. The other three died after "Operation 1" or "Operation 2" was performed as a repeat procedure. These dogs died with signs of respiratory difficulties caused by softening of too long a segment of the cervical trachea by the fenestrations performed at each operation.

Comments

Successful fenestrations healed from 19 to 55 days after the operation. Figure 3 represents a fenestration 41 days after the operation and shows the skin valves in a relaxed position and covering the tracheal window. Figure 4 demonstrates the fenestration with the valves stretched, displaying the skin lined tract leading to the tracheal window.

By the time the tracheal fenestration is healed, it has a completely skin-lined or epithelialized tract on the neck, leading to a skin-lined or epithelialized opening of the cervical trachea. The skin valves keep the tracheal window covered unless they are stretched in an outward direction, which opens the route to the window. Of course, when desired, the tracheal fenestration can be closed permanently by surgery. The fenestrated dogs can easily be catheterized or bronchoscoped through this opening. This possibility makes them excellent subjects for experimental studies.

The desirability of tracheal fenestration of the type here described suggested itself to us by observations of patients with conventional tracheostomy and metal cannula. In fact, the difficulties experienced in the use of the latter for prolonged suctioning and medication of the tracheobronchial tree have led us to seek the advantages of tracheal fenestration. Having demonstrated the feasibility of the fenestration in animals, we are naturally turning our attention to its usefulness and its aapplicability in patients. We are not yet in a position to report experience in clinical cases in which this new method has been performed. However, in support of our proposal of tracheal fenestration it seems justified to discuss some of the clinical aspects which distinguish it from conventional tracheostomy as now practiced. This will be presented in detail in a succeeding publication.

Acknowledgment: We are indebted to Dr. Clarence R. Straatsma for his interest in this procedure.

SUMMARY

Experiments leading to a satisfactory operative technic in the production of fenestration of the trachea of dogs are presented. The advantages of the fenestrated animals as experimental subjects are emphasized. The clinical possibilities of a window in the cervical trachea are discussed with particular reference to the management of widespread pulmonary suppuration.

RESUMEN

Se presentan experimentos para obtener una técnica operatoria conveniente de fenestración de la tráquea en el perro. Se recalcan las ventajas de los animales "fenestrados" experimentalmente. Las posibilidades clínicas de contar con una ventanilla en la tráquea cervical se discuten, especialmente en lo que se refiere al tratamiento de la supuración pulmonar difusa.

RESUME

Les auteurs présentent les expériences qui ont permis une technique opératoire satisfaisante pour l'ouverture de la trachée chez les chiens. Ils insistent sur les avantages des animaux "fenêtrés" comme sujets expérimentaux. Ils discutent les possibilités cliniques d'une fenêtre dans la trachée cervicale en insistant particulièrement sur le traitement de la suppuration pulmonaire extensive.

ZUSAMMENFASSUNG

Es werden Experimente beschrieben, die zu einer befriedigenden operativen Technik in der Herstellung einer Fensterung der Trachea bei Hunden führen. Die Vorteile der gefensterten Tiere als Versuchsobjekte werden hervorgehoben. Die klinischen Möglichkeiten eines Fensters im Halsteil der Trachea werden besprochen mit besonderer Beziehung zur Behandlung von ausgedehnten Lungeneiterungen.

Case Report Section

Asbestosis: Report of a Case*†

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South Mountain, Pennsylvania

W. E. B., an unmarried, white male, 47 years of age, was admitted to the Mont Alto Sanatorium, May 13, 1953; his chief complaints were weakness, loss of weight and shortness of breath, especially upon exertion. The temperature was 98.0, pulse 100, respirations 30; red and white blood cell counts were within normal limits; he weighed 97 pounds (38 pounds below normal). The family and past histories were not informative except that he had worked in the dusty atmosphere of an asbestos plant for 38 years before the onset of the present illness, in February, 1953. Then he consulted a physician because of annoying cough, weakness, loss of weight and increasing shortness of breath. Three x-ray films of his chest had been taken by the company for which he had worked. The first in December, 1945, showed shadows consistent with approximately second stage asbestosis and some dilatation of the right heart; it was then recommended that he have another x-ray film within eight to nine months but this was not done until April, 1950. This showed in addition to the above findings, evidence of bronchopneumonic type of infection—probably virus pneumonia. It was then recommended that he have another x-ray film within two weeks. In March, 1953 a third film was taken (shortly after he had consulted a physician) and he was told he had asbestosis and should consult a state clinic where arrangements were made for admission to Mont Alto Sanatorium.

While in the sanatorium his general condition improved for a few days more than four months; cough became less irritating, dyspnea less annoying, his appetite improved and he gained eight pounds. Chest x-ray films taken May 13 and July 31, 1953, presented a ground-glass appearance with small nodular mottling throughout and fine reticulate markings in the basal portions of both lungs. Assiduous laboratory work failed to demonstrate acid-fast bodies or asbestosis bodies in the sputum. His condition worsened abruptly during the morning of September 20; he became dyspneic and cyanotic, the pulse jumped to 116, the respirations rose to 36. He was placed immediately in an oxygen tent and proper medication was administered. After a brief period of apparent improvement his condition gradually became worse and he died September 23, 1953.

At autopsy the body was greatly emaciated, the chest was flat and the accessory respiratory muscles were prominently hypertrophied. The lungs were relatively smooth, glistening, sometimes finely puckered, firm and

†From the Medical Department of the Mont Alto Sanatorium.
*Presented at the Annual Meeting, Pennsylvania Chapter, American College of Chest Physicians, South Mountain, Penna., September 30, 1954.
**Senior Resident Physician, Mont Alto Sanatorium.
¶Pathologist, Mont Alto Sanatorium, Waynesboro Hospital and Chambersburg Hospital, Penna.

leathery in consistency and of a peculiar grayish red coloration. A few fine, old fibrous adhesions involved the right apex and the inferior lateral margins of the same lung. The middle lobe of the right lung was missing and was replaced by a single solid lobe occupying the normal space and position of the upper and middle lobes. On deep palpation there was a distinct, peculiar, sensation resembling buckshot felt through a thick layer of rubber or leather. On sectioning the lung substance, in general, presented a deep-red coloration with little normal, spongy alveolar substance. Instead there was a wide spread, sharply demarcated development of fibrosis which at no point presented suppuration, hepatization, cavitation, caseation or indications of tubercle formation.

The heart was of cor bovinum size, shape and form. All chambers were greatly dilated, particularly the right side which was also hypertrophied. The myocardium was uniformly pale and pinkish yellow; the valves were smooth and competent. Atheromatous changes were present in the coronary vessels and the aorta.

Microscopically the picture varied from field to field. In some areas alveoli could be readily identified and were usually characterized by variable dilatation of an emphysematous type, associated with increasing interstitial fibrosis, severe congestion and dilatation of the vessels. In other areas there was extensive and even massive fibrosis reducing the alveolar elements to small dust-like structures. Inflammatory leukocytes were only occasionally identified and played a minimal part; foreign body giant cells, while present, were rarely seen. Throughout the dense, fibrocollagenous areas extensive irregular fields were present in which the collagen had undergone a fine, granular, fibrillar degeneration, that did not, however, develop into true necrosis. Typical asbestosis bodies were found in many of these areas as well as in some of the fibrous tissue areas. These usually were seen well within the stroma but were also found associated with alveolar and bronchiolar elements. Under polarized light fine needles representing the original asbestos fibres were also seen. The fibrosis and massing scarring appeared to be the result of fibrous thickening of the alveolar septae with compression narrowing and ultimate obliteration of the alveolar spaces.

The lymph nodes showed moderate edema and considerable hyperplasia of the reticulo-endothelial cells. A few areas of focal fibrosis, within which a number of small asbestosis bodies were present, were seen.

Kartagener's Triad
(Situs Inversus, Bronchiectasis and Sinusitis)

REPORT OF A CASE

LT. COL. DAVID L. DEUTSCH, MC, USA
Fort Knox, Kentucky

Recent reports[4] have stressed the importance of doing bronchograms and sinus studies on people with situs inversus because of the greater incidence of bronchiectasis and chronic sinusitis in these people. The incidence of bronchiectasis at Massachusetts General Hospital in 232, 111 admissions was 0.3 per cent as compared to 21.7 per cent in the 23 cases of situs inversus.[3] The Mayo Clinic and the State of Wisconsin General Hospital had similar statistics.[1]

Since Kartagener's report of 11 cases of bronchiectasis, chronic sinusitis and situs inversus there have been a total of 41 cases reported up to 1951. Two more were reported by Gross[1] and one by Katz et al[4] in 1953.

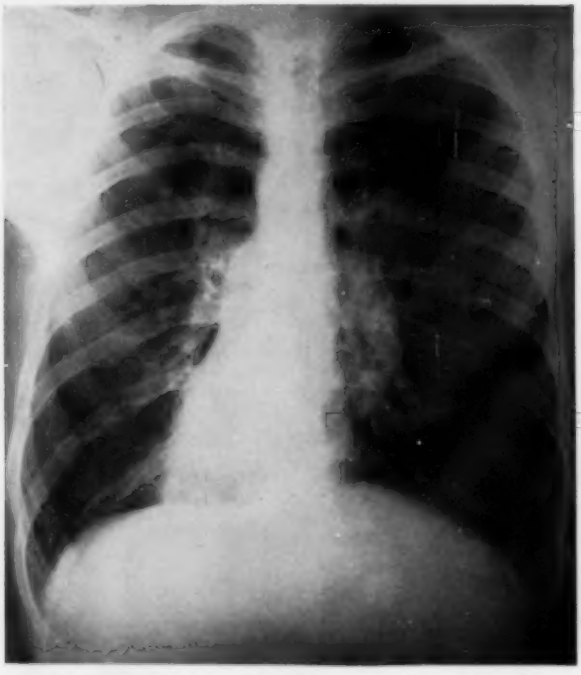

FIGURE 1: Chest film showing situs inversus of chest structures and irregular confluent basilar markings consistent with bronchiectasis.

Assistant Chief, Medical Service, U. S. Army Hospital.

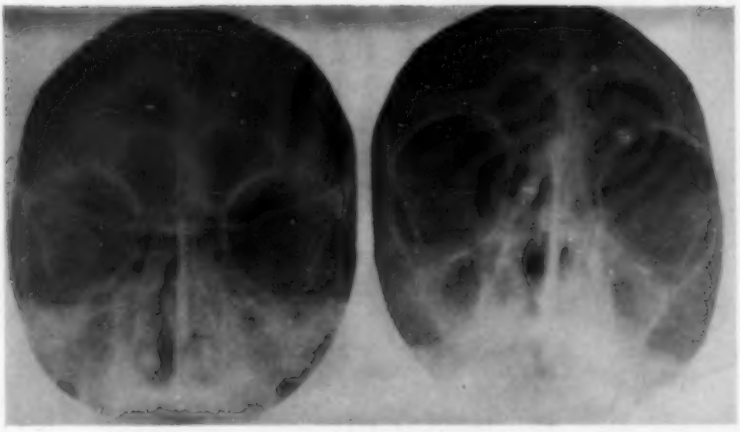

FIGURE 2: Skull film showing marked thickening of mucous membranes of maxillary and ethmoid sinuses bilaterally.

I am reporting an additional case with a coincidental diagnosis of acute rheumatic fever.

This 21 year old caucasian was always in good health until he developed redness, swelling and pain in both knees and ankles the day prior to entry into the hospital. About 10 days prior to admission he had a several day bout of upper respiratory infection with a slight sore throat. Physical examination was negative except for dextrocardia and red, swollen, tender

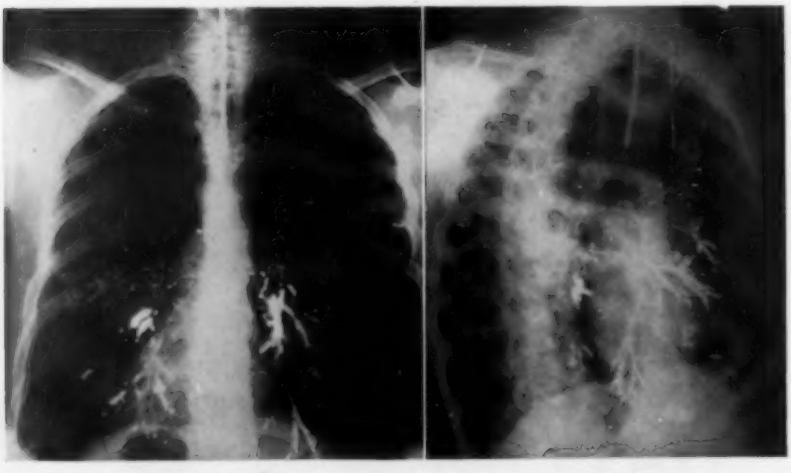

FIGURE 3 FIGURE 4

Figure 3: Bronchogram showing irregular cylindrical bronchiectasis involving multiple basal segments bilaterally, left middle lobe and lingular division of right lung.—*Figure 4:* Bronchogram showing cylindrical bronchiectasis of left middle lobe (lungs are transposed).

knees and ankles bilaterally. No murmur was heard. His course was fairly typical of acute rheumatic fever with rapid subsidence of signs and symptoms of joint involvement on aspirin. Also other signs of rheumatic activity soon became negative including sedimentation rates, C-reactive proteins, and minor nonspecific T-wave changes on electrocardiogram.

In view of the dextrocardia a search for manifestations of Kartagener's triad was conducted as well as proving that situs inversus universalis existed. A gastrointestinal x-ray series showed the stomach to be on the right side. The gall bladder by x-ray study was also reversed and on the left side. Films of the sinuses showed definite marked thickening of the mucous membranes of both maxillary and ethmoid sinuses. The chest film revealed confluent and irregular vascular markings to both bases consistent with bronchiectasis. A bronchogram using lipiodol showed evidence of bronchiectasis of the basilar portions bilaterally, left middle lobe and right lingular division. See illustrations.

He never had clinical manifestations of sinusitis or bronchiectasis.

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ANNUAL MEETINGS

Board of Regents and Board of Governors

The Board of Regents and the Board of Governors of the College held their annual meetings at the Hotel Sherman, Chicago, Illinois, on Wednesday and Thursday, June 6 and 7, in connection with the 22nd Annual Meeting of the American College of Chest Physicians. The following Regents, Governors, Alternates and chairmen of councils and committees were officially registered:

John F. Briggs, St. Paul, Minnesota, Chairman, Board of Regents
David H. Waterman, Knoxville, Tennessee, Chairman, Board of Governors

Osler A. Abbott, Emory University, Georgia
William E. Adams, Chicago, Illinois
Arnold S. Anderson, St. Petersburg, Florida
Robert J. Anderson, Washington, D. C.
Albert H. Andrews, Chicago, Illinois
Norman Arcese, Seattle, Washington
Carl C. Aven, Atlanta, Georgia
Andrew L. Banyai, Milwaukee, Wisconsin
Alvan L. Barach, New York, N. Y.
B. Guy Begin, Montreal, Canada
Otto L. Bettag, Chicago, Illinois
Otto C. Brantigan, Baltimore, Maryland
Charles A. Brasher, Mount Vernon, Missouri
Alfred A. Busse, Jefferson, Wisconsin
William P. Chester, Detroit, Michigan
Ross K. Childerhose, Harrisburg, Pennsylvania
Sumner S. Cohen, Oak Terrace, Minnesota
Lawrence R. Coke, Winnipeg, Canada
James P. Cooney, Washington, D. C.
Arthur W. Dahlstrom, Albuquerque, New Mexico
Edgar W. Davis, Washington, D. C.
Everett C. Drash, Charlottesville, Virginia
Seymour M. Farber, San Francisco, California
Max Fleishman, Omaha, Nebraska
M. Jay Flipse, Miami, Florida
Carl H. Gellenthien, Valmora, New Mexico
Alfred Goldman, Los Angeles, California
Alfred Goldman, St. Louis, Missouri
Burgess L. Gordon, Philadelphia, Pennsylvania
Joseph Gordon, Albuquerque, New Mexico
William Paul Gray, Batesville, Arkansas
Edward A. Greco, Portland, Maine
Alvis E. Greer, Houston, Texas
J. E. J. Harris, Albuquerque, New Mexico
Thomas G. Heaton, Toronto, Canada
George R. Herrmann, Galveston, Texas
Paul H. Holinger, Chicago, Illinois
Willard B. Howes, Detroit, Michigan
William A. Hudson, Detroit, Michigan
Chevalier L. Jackson, Philadelphia, Pennsylvania
Miguel Jimenez, Mexico City, Mexico
Hollis E. Johnson, Nashville, Tennessee
Robertson O. Joplin, Louisville, Kentucky
Francis J. Kasheta, Glencliff, New Hampshire
Edward Lebovitz, Pittsburgh, Pennsylvania
Joe H. Little, Mobile, Alabama
George R. Maxwell, Morgantown, West Virginia
Donald W. McCauley, Okmulgee, Oklahoma
Donald R. McKay, Buffalo, New York
George R. Meneely, Nashville, Tennessee

Francisco J. Menendez, Havana, Cuba
Frank A. Merlino, Providence, Rhode Island
Arnold Minnig, Denver, Colorado
Herman J. Moersch, Rochester, Minnesota
Robert B. Morrison, Austin, Texas
Leslie Mullen, Calgary, Canada
Jay Arthur Myers, Minneapolis, Minnesota
Theodore H. Noehren, Buffalo, New York
Dan C. Ogle, Washington, D. C.
Arthur M. Olsen, Rochester, Minnesota
Richard H. Overholt, Boston, Massachusetts
Jerome V. Pace, Rockville, Indiana
J. Winthrop Peabody, Sr., Washington, D. C.
Charles K. Petter, Waukegan, Illinois
Joseph C. Placak, Sr., Cleveland, Ohio
Charles Pokorny, Halstead, Kansas
Coleman B. Rabin, New York, N. Y.
Howell S. Randolph, Phoenix, Arizona
Howard F. Root, Boston, Massachusetts
Robert B. Schwartz, Hattiesburg, Mississippi
Charles W. Scott, Burkeville, Virginia
J. Gordon Seastrunk, Columbia, South Carolina
P. J. Sparer, Memphis, Tennessee
Clifford F. Storey, San Diego, California
Lawrence H. Strug, New Orleans, Louisiana
Charles F. Taylor, Norton, Kansas
Frank I. Terrill, Deer Lodge, Montana
Harold G. Trimble, Oakland, California
Kenneth A. Tyler, Gooding, Idaho
Howard S. Van Ordstrand, Cleveland, Ohio
Buford H. Wardrip, San Jose, California
Irving Willner, Newark, New Jersey
Roy A. Wolford, Washington, D. C.
W. Bernard Yegge, Denver, Colorado
Murray Kornfeld, Chicago, Illinois, Executive Director
Harriet L. Kruse, Chicago, Illinois, Executive Assistant

The annual meeting of the Board of Regents was held on Wednesday, June 6, and the joint meeting of the Board of Governors and Board of Regents was held on Thursday morning, June 7. Dr. Otto L. Bettag, Chicago, Regent of the College, chairman of the Committee on General Arrangements for the 22nd Annual Meeting, was introduced. Dr. Bettag spoke briefly about the arrangements for the meeting and a vote of appreciation was extended to him and to the members of his committees for their splendid cooperation.

The Board adopted a resolution to extend their best wishes for a speedy recovery to Dr. James H. Stygall, President of the College, who was unable to attend the meeting because of illness.

The following officers were elected:

Dr. Edward A. Greco, Portland, Maine, was elected to the Committee on Nominations to represent the Board of Regents.
Dr. Alfred Goldman, St. Louis, Missouri, was elected a member of the Executive Council.
Dr. John F. Briggs, St. Paul, Minnesota, was re-elected Chairman of the Board of Regents.
Dr. Arnold S. Anderson, St. Petersburg, Florida, was elected to the Committee on Nominations to represent the Board of Governors.
Dr. David H. Waterman, Knoxville, Tennessee, was re-elected Chairman of the Board of Governors.
Dr. Henry C. Sweany, Mount Vernon, Missouri, was re-elected a member of the Editorial Board for *DISEASES OF THE CHEST*.

Reports presented at the Board meetings are published in this issue of the journal and additional reports will appear in subsequent issues.

Report of the Treasurer

STATEMENT OF INCOME AND EXPENSES FOR THE YEAR ENDED DECEMBER 31, 1955

INCOME:		
Annual Dues		$ 92,395.93
Fellowship Fees		27,876.50
Sales—		
Advertising	$36,860.39	
Subscriptions	25,385.54	
Exhibit Space	4,679.13	
Directory	620.51	
College Services—Net	11,688.24	
	$79,233.81	
Less—Discount Allowed	7,300.27	71,933.54
Interest Received on U. S. Savings Bond		832.50
Interest on Investment in Savings & Loan Association		279.17
TOTAL INCOME		$193,317.64
EXPENSES:		
Salaries	$54,800.00	
Printing Journal	48,185.03	
Building Account	4,601.78	
Printing and Engraving	3,488.53	
Handling and Posting Journal	5,410.28	
Postage and Shipping	3,927.78	
Officers' and Committee Expense	4,068.89	
Telephone and Telegraph	2,291.08	
Office Expense	2,422.70	
Travel—Executive Director	1,914.35	
Annual Meeting	6,585.22	
Semi-Annual Meeting—Board of Regents	1,683.68	
International Meeting	2,804.16	
Public Relations Expense	1,689.73	
Editor of Journal	1,821.00	
Hospital Counselor	1,012.72	
Library Expense	245.89	
Membership Certificates	419.90	
Payroll Taxes	734.31	
Directory Costs	14,746.86	
Prize Essay Award	632.99	
Audit	250.00	
Contribution to World Medical Association	500.00	
College Medal	45.30	
Contribution to National Society for Medical Research	25.00	
Depreciation—Furniture and Fixtures	1,274.85	
Total Expenses		$165,582.03
NET INCOME		27,735.61

Ralph H. Marcus, Certified Public Accountant, Chicago, Illinois.

Charles K. Petter, Treasurer.

Report of the Committee on Membership

Between September 15, 1955 and March 15, 1956, 300 applications from all parts of the world were received and presented to the Board of Regents. Of these applications, 137 were for Fellowship, 62 for Associate Fellowship, 47 for Associate Membership and 54 for Advancement to Fellowship. Of this group, 192 were from physicians in the United States and Canada, and 108 were filed by physicians in other countries.

With the admission of 242 new members from all parts of the world, the total membership of the College is now 5550. We have on hand 52 applications which have been filed since March 15, and May 15, 1956. This group will be held for presentation to the Board of Regents at our Interim Session in November 1956.

Chevalier L. Jackson, Chairman

Report of the Council on Postgraduate Medical Education

The Council is pleased to report that during the period June, 1955 to June, 1956, postgraduate courses on diseases of the chest sponsored by the Council on Postgraduate Medical Education of the College were presented in Chicago, New York City, Los Angeles and Philadelphia. These courses consisted of five full days of lectures and round table luncheon discussions and all were well attended. In addition, a postgraduate course on diseases of the chest designed to interest general practitioners, was presented in Pittsburgh last October. These lectures were presented on four successive Sundays and were attended by 49 physicians in that area.

Two postgraduate courses will be presented this coming fall, the 11th Annual Postgraduate Course to be held in Chicago, October 15-19; and the 9th Annual Postgraduate Course to be held in New York City, November 12-16. The 10th Annual Postgraduate Course on Diseases of the Chest will be presented in Philadelphia in the spring of 1957. Other courses are being contemplated and announcement will be made as soon as the dates and places are decided upon.

The Council has cooperated in the presentation of postgraduate courses in Cuba, the Philippines and Peru, during past few years, as well as with medical schools and clinics in many other parts of the United States. During the period 1946-1956, physicians numbering 2,907 have registered for the postgraduate courses sponsored by the American College of Chest Physicians.

J. Winthrop Peabody, Chairman

Report of the Council on Public Health

The report of this Council, which appeared in the November, 1955 issue of the College journal, *DISEASES OF THE CHEST*, entitled "The Participation of Physicians in Private Practice in Basic Tuberculosis Control Procedures" received wide notice, and great interest in the report was expressed by medical societies, public health officials, and the medical profession at large.

A number of reprints were supplied to the Council and the supply was soon exhausted. Many associations requested permission to reproduce the article in their respective bulletins or publications. A reproduction of the report prepared by the Brooklyn Tuberculosis and Health Association was sent to every member of the Kings County Medical Society and to the New York City press. The City of Los Angeles, Department of Health distributed the report to over 900 physicians in their county, medical schools, hospitals, nursing schools, colleges, and also to the local press.

Among the other groups requesting permission to reprint and distribute the report are: New York City Department of Health, State of New Jersey Department of Health, Maine Medical Association, City of Oakland Department of Public Health, Bronx Tuberculosis and Health Committee, New Hampshire Tuberculosis Committee, Alameda County Tuberculosis and Health Association, and the U. S. Public Health Service. Requests have also been received from public health groups in other countries.

Our council wishes to pay tribute to the Committee on Liaison with State and County Medical Societies for their cooperation in distributing the report to the state and county medical societies. The council is very much enthused by the response and is considering the preparation of similar reports concerning other public health problems.

Robert J. Anderson, Chairman.

Report of the Council on Hospitals

The reports of the committees which comprise the Council on Hospitals are published periodically in "The Hospital Counselor." During the past year, the Committee on Resident Fellowships was placed under the jurisdiction of the Council on Hospitals. The activities of this important committee will be published in future issues of "The Hospital Counselor."

The November, 1955 issue of "The Hospital Counselor" which was devoted to nursing in tuberculosis, received wide notice and interest. Many nursing and tuberculosis associations requested copies which were subsequently reproduced in their respective publications. Because of the unprecedented demand for this particular issue, orders from the U. S. Public Health Service, The Arkansas State Board of Health, The Ohio Department of Health, and other agencies had to be returned unfilled with permission to reproduce any and all articles for distribution to interested nurses and physicians.

The Council on Hospitals is anxious to receive recommendations from the members of the Board of Governors and Regents for topics which may be included in the future issues of "The Hospital Counselor."

Charles A. Brasher, Chairman

Report of the Committee on Resident Fellowships

The Committee on Resident Fellowships has now been operating for five years. Under the direct sponsorship of the American College of Chest Physicians, the Committee has been approved by the Department of State, Washington, D. C. for an exchange visitor's program number. The Manhattan General Hospital, New York City, has made a room available to the committee and the resident fellows. A bronze plaque, reading as follows, has been installed in this room:

New York Headquarters
Committee on Resident Fellowships
Council on International Affairs
American College of Chest Physicians

From 1951 to 1956, the committee received 176 requests for information concerning postgraduate medical education. Sixty physicians from the following 28 countries have had or are now in postgraduate training in various hospitals, clinics, and universities throughout this country: Egypt, Korea, Turkey, Germany, India, Philippines, Jordan, Israel, Spain, Costa Rica, Formosa, England, Greece, Panama, South Africa, Portugal, France, Brazil, Netherlands, Japan, Venezuela, Argentina, Iran, Chile, Italy, Colombia, Austria, and Nicaragua.

The committee program has been highly commended by the Pan-American Sanitary Bureau, the Department of State, the American-Korean Foundation, and other government and private organizations.

Alfred A. Richman, Chairman

Report of the Committee on College Chapters

In reviewing the progress made by our College chapters in the United States, it is a pleasure to report that 22 of our 30 domestic chapters held scientific sessions in 1956. The others will hold their annual meetings in the fall of the year and plans for their programs are now in progress. The attendance at the meetings in 1956 shows a decided increase over 1955 and, from the comments received from physicians attending the meetings, the scientific programs were excellent.

In the international picture, it is a pleasure to report that all of our 36 chapters are active and are holding scientific sessions. Many of these chapters meet several times a year and often hold special meetings for visiting physicians.

The other international chapters will meet during the fall months. The Middle East Chapter, composed of our members in Cyprus, Saudi Arabia, Kuwait, Lebanon, Iraq, Syria and Jordan, will hold its Second Congress in Bhamdoun, Lebanon on August 10-12 this year, and a very large attendance is expected.

The Committee on College Chapters will continue to work closely with chapter officials in connection with their meetings, and we expect to see continued growth and development in chapter meeting attendance and activities.

Alvis E. Greer, Chairman

Report of the Committee on College Essay
1956 Prize Essay Contest

This year, the Committee on College Essay received 32 requests for information concerning the 1956 Essay Award Contest. Twelve applications were received, and ten essays were submitted. The first, second, and third place winners are listed below. There was a tie for third place. The first prize was $250, second prize, $100, and each of the third prize winners have received $50. All of the winners have received certificates of merit.

First Place

"Sputum Cytology Following Enzyme Aerosol Therapy"
Lawrence Alan Farber
University of Buffalo School of Medicine
Buffalo, New York

Second Place

"Scalene Node Biopsy: Its Value as a Diagnostic Aid in Chest Diseases"
Peter Schiff and Bruce Warren
University of Sydney New Medical School
Sydney, Australia

Third Place

"The Diagnostic Significance of Pleural Effusion"
Thomas Ungerleider
Western Reserve University School of Medicine
Cleveland, Ohio

and

"Coronary Heart Disease"
E. Francis Fredericks
B. J. Medical College
Ahmedabad, India

Joseph S. Hiatt, Chairman

1957 Prize Essay Contest

The 1957 Prize Essay Contest is now open to undergraduate medical students throughout the world. Upon the recommendation of the Committee on College Essay and the approval of the Board of Regents of the College, the awards have been increased to $500 for first prize, $300 for second prize, and $200 for third prize. Winners will also be awarded certificates of merit.

The Board of Regents of the College has requested the cooperation of members affiliated with medical schools in bringing the contest to the attention of the student body at their respective schools. Essays may be submitted on any phase relating to the diagnosis and treatment of cardiac or pulmonary diseases. The contest will close on April 10, 1957 and instructions for the preparation of manuscripts are as follows:

1) Five copies of the manuscript, typewritten in English, double spaced, should be submitted to the Committee on College Essay, American College of Chest Physicians, 112 East Chestnut Street, Chicago 11, Illinois, U. S. A.
2) The only means of identification of the author shall be a motto or other device on the title page and a sealed envelope bearing the same motto on the outside, enclosing the name and address of the author.
3) A letter from the Dean or Chairman of the Department of Medicine or Surgery of the medical school, certifying that the author is a medical student.

Interim Session
American College of Chest Physicians

The Interim Session of the College will be held at the Hotel Benjamin Franklin, Seattle, Washington, November 25-26, 1956. Dr. Norman Arcese, Seattle, has been appointed chairman of the Committee on Scientific Program.

Scientific Program Committee Requests Submittal of Abstracts for 1957 Meeting

The 23rd Annual Meeting of the American College of Chest Physicians will be held at the Hotel Commodore, New York City, May 29 through June 2, 1957. Plans for the scientific program to be presented at this meeting are already under way. Emphasis will be placed on papers dealing with new and original research and investigation. One feature of the program will be a session devoted solely to a series of such papers limited to ten minutes for each presentation.

The committee urges those wishing to present papers to submit a 200 word abstract to Karl H. Pfuetze, M.D., Chairman, Committee on Scientific Program, 1919 West Taylor Street, Chicago, Illinois, before December 1, 1956.

College Chapter News

MICHIGAN CHAPTER

The annual meeting of the Michigan Chapter will be held at the Sheraton-Cadillac Hotel, Detroit, on September 27. The meeting will consist of a dinner at 6:00 p.m. and Dr. Paul H. Holinger, Chicago, Illinois, will address the chapter at 8:00 p.m. on the subject, "The Bronchoscopic Appearance of Bronchopulmonary Lesions."

KENTUCKY CHAPTER

The Kentucky Chapter will hold its annual meeting in conjunction with the meeting of the Kentucky State Medical Association in Louisville on September 18 and 19 at the Brown Hotel, Louisville. Dr. Paul T. Chapman, Detroit, Michigan, will speak on "Present Status of Chemotherapy for Tuberculosis" under the sponsorship of the chapter in the state association general session on September 18. The program for the chapter meetings on September 19 is as follows:

"Spontaneous Pneumothorax, Results of Pulmonary Resection"
Porter Mayo, Lexington

"Hospital and Post-Sanatorium Treatment of Tuberculosis in Detroit"
Paul T. Chapman

"Pleurisy with Effusion"
Daniel Pickar, Louisville

"Clinical Application of Pulmonary Function Studies"
Grover B. Sanders, Louisville

RIO GRANDE DO SUL CHAPTER (BRAZIL)

The Rio Grande do Sul Chapter of Brazil held its annual meeting in Porto Alegre on May 3 at the home of Dr. Carlos Bento, Governor of the College. The meeting was opened by Dr. Bento and the following officers were elected:

President:	Jose Eboli, Porto Alegre
1st Vice President:	Antonio Alves Azambuja, Porto Alegre
2nd Vice President:	Cezar Santos, Passo Fundo
Secretary:	Henrique Domingos Faillace, Porto Alegre
Treasurer:	Francisco Marques Pereira, Porto Alegre

ISRAEL CHAPTER

The annual meeting of the Israel Chapter was held at the Eitanim Sanatorium, Jerusalem, May 29 and 30. The following program was presented:

"Follow up of a Series of Cases Discharged from Sanatoria up to the End of 1952"
M. Silberstein, Beer Yaakov

"Follow up After Segmental Resection in Tuberculosis"
Y. M. Pauzner, Raanana

"Follow up After Extraperiosteal Plombage in the Treatment of Pulmonary Tuberculosis"
H. Milwidski and H. Romanoff, Jerusalem

"Follow up on 172 Cases of Tuberculosis Treated by Monaldi Procedure"
M. Mendes, Jerusalem
"Drainage of Lung Abscess According to Monaldi"
J. Rakower and P. Wayl, Jerusalem
"Significance of Lymphatics in the Pathogenesis of Tuberculosis"
H. Itelson, Tel-Aviv
"Perforation of Tuberculous Lymph Nodes into the Bronchi in Adults"
S. Adler and L. Hermann, Beer-Yaakov
"Treatment with Trypsin in Tuberculous Lymphadenitis"
D. Rapoport, Beer-Yaakov
"Middle Lobe Syndrome"
C. Weinart, Tev-Aviv
"Pulmonary Actinomycosis"
P. Wayl and J. Rakower, Jerusalem
"Electrophoresis in Pulmonary Tuberculosis"
B. Krzypow, Tel-Aviv
"Tuberculosis in Industry"
S. Einhorn, Tel-Aviv
"Osteoarthropathy in Malignant Tumors of the Lungs"
N. Schor, Jerusalem
"Tuberculosis of the Urinary Tract"
A. Avigdori, Jerusalem

New chapter officers elected at the meeting are:

President:	Kurt Friedmann, Tel-Aviv
President-Elect:	Hermann Lichtenstein, Haifa
Secretary-Treasurer:	Wilhelm Hupert, Kfar-Saba (re-elected)

A dinner was held following the meeting for members and guests.

College News Notes

The Li Shu-Fan Block of the Hong Kong Sanatorium and Hospital, Happy Valley, was opened on June 13 by the Honorable Dr. K. C. Yeo, Director of Medical and Health Services. This new 8-floor block named in honor of **Dr. Li Shu-Fan,** Governor of the College, is equipped with 88 beds, bringing the total bed capacity of the hospital to 338. Dr. Li, who has served as Chairman of the Board of Directors of the hospital for the past 30 years, announced that the opening of the new block marked his long-time decision that on the day of the opening he would retire from his private practice of 44 years. The new block, completely modern in all respects, contains an out-patient department for charity and private patients, operating rooms, clinical laboratory, nursery, auditorium, and chapel. The Hong Kong Sanatorium is the only private non-subsidized hospital in the Colony which operates a training school for nurses.

Dr. Charles P. Cake, Arlington, Virginia, has been named the third recipient of the Douglas Southall Freeman Award. This award is given by the Virginia Tuberculosis Association to the person judged to have contributed the most in the year preceding, or to an unusual degree over a period of years to the cause of tuberculosis control in the state.

CARDIOVASCULAR RESEARCH AWARD

The Section on Cardiovascular Physiology of the Council on Research, American College of Chest Physicians, offers an award of $500 for the best manuscript on "Acute Pulmonary Edema." The study may be of either an experimental or a clinical type and may include problems of therapy. The original work, based on personal research, should be presented before January 1, 1957. It may consist of an unpublished manuscript or a recently published article (after December 31, 1955). If the manuscript is unpublished, publication may take place either in *DISEASES OF THE CHEST* or in another journal, according to the wish of the author.

For further information, please write to Dr. Aldo A. Luisada, Chairman, Section on Cardiovascular Physiology, American College of Chest Physicians, 112 East Chestnut Street, Chicago, Illinois.

BOOK REVIEW

PULMONARY CARCINOMA. Edited by Edgar Mayer, M.D. and Herbert C. Maier, M.D. Published by New York University Press and distributed by J. B. Lippincott Co., Philadelphia. 540 pages, $15.

In no other division of chest medicine has there been such intensive research in so many directions as has taken place in the field of pulmonary malignancy in the last twenty years. Today this is an area not of the expert, but of many experts.

This circumstance makes the achievement of the editors, Drs. Edgar Mayer and Herbert C. Maier, and their associates all the more remarkable. Because of its incisive, clear command of the best in modern thought upon the subject, this book would be invaluable if it had confined itself merely to the basic clinical subjects of etiology, pathology and diagnostic methods. But it happily ranges much farther afield. In addition to an authoritative presentation of the topics usually considered in a book of this nature, there is a series of remarkably thorough discussions of literally all contemporary approaches to the clinical management of bronchogenic carcinoma—radiotherapy, chemotherapy, radioisotopes and psychological aspects. The illustrations are admirably selected to clarify the text, and the indispensable ancillary portions of a book of this scope—indices, bibliography and so forth—are more than ample.

The authors point out in their preface that due to the great increase in incidence in the past few decades, pulmonary carcinoma has become a major clinical problem. This observation is undoubtedly true, and it is the reason that this book should be in the library of every practicing physician. It will remain the basic work on lung cancer for many years to come.

Seymour M. Farber, M.D.

Obituary

STEFAN IRIMESCU
(1874-1956)

Stefan (Fanica) Irimescu was born in Ploesti, Roumania. After graduating in medicine in Paris, France in 1902, he returned to Roumania. He soon decided to specialize in tuberculosis. His first papers dealt with the ophthalmoreaction, and with tuberculin and paratuberculins in experimental medicine. In 1906 he became medical director of the first tuberculosis sanatorium in Roumania, the "Filaret," at the outskirts of Bucharest. In 1908, Irimescu was sent to Washington, D. C. to represent Roumania at the sixth International Congress on Tuberculosis. He fulfilled with dignity the function of Roumanian delegate at the international antituberculous meetings of the following 30 years, became well known in international circles, and held for many years a seat on the board of the International Union Against Tuberculosis.

At home, Irimescu was the recognized "father of tuberculosis." Between the First and Second World Wars, he continued as director at Filaret, and built up the largest private practice in tuberculosis in Roumania (with extensive use of artificial pneumothorax since 1908). He aided in founding the semi-official "National League against Tuberculosis" and initiated the Roumanian Antituberculous Congresses.

In 1941 he retired from the direction of Filaret, and lived at his home in Bucharest, or in the summer villa in Sinaia. His library contained over 2500 books, and he subscribed to over 30 magazines. He had a phenomenal memory, and a truly encyclopedic knowledge of universal literature, arts, and music.

Late in 1955, he suffered a stroke and on February 16, 1956, died from terminal bronchopneumonia. Stefan Irimescu is survived by his wife, two daughters and eight grandchildren.

Emanuel R. N. Grigg, M.D.

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HENRY W. MALY, M.D. Director
Cragmor Sanatorium
Colorado Springs, Colorado

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Assistant medical director wanted for Mineral Springs Sanatorium, Cannon Falls, Minnesota, 100 bed county tuberculosis hospital with active medical, surgical, out-patient, and investigative programs. Salary determined by experience. Furnished home and utilities supplied. Applicant must be male graduate of approved U. S. or Canadian medical school and eligible for Minnesota license. Address: E. V. Bridge, M.D., Superintendent.

Clinical research in chest diseases—available September 1, 1956; W. P. Harris Fellowship, $7500 per annum, extensive clinical facilities and active research program. Write: Gardner Middlebrook, M.D., Research Director, National Jewish Hospital, 3800 East Colfax Avenue, Denver 6, Colorado.

Medical directorship, Firland Sanatorium King County (Seattle, Washington) Tuberculosis Hospital. 750 beds. Excellent staff and facilities, affiliation University of Washington. Salary $12,000-$16,000. Apply to James W. Mifflin, Seaboard Building, Seattle, Washington.

CALENDAR OF EVENTS

NATIONAL AND INTERNATIONAL MEETINGS

Fourth International Congress on Diseases of the Chest
Council on International Affairs
American College of Chest Physicians
Cologne, Germany, August 19-23, 1956

Interim Session, American College of Chest Physicians
Seattle, Washington, November 25-26, 1956

POSTGRADUATE COURSES

11th Annual Postgraduate Course on Diseases of the Chest
Hotel Knickerbocker, Chicago, October 15-19, 1956

9th Annual Postgraduate Course on Diseases of the Chest
Park-Sheraton Hotel, New York City, November 12-16, 1956

CHAPTER MEETINGS

Colorado Chapter, Estes Park, September 8, 1956
Kentucky Chapter, Louisville, September 18-19, 1956
Michigan Chapter, Detroit, September 27, 1956

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Medical Director
Buford H. Wardrip, M.D.
Telephone Clayburn 8-4921

Associate Medical Director
C. Gerald Scarborough, M.D.

Visiting Medical Staff:

Harold Guyon Trimble, M.D., Oakland
Cabot Brown, M.D., San Francisco
J. Lloyd Eaton, M.D., Oakland
Gerald L. Crenshaw, M.D., Oakland
Glenroy N. Pierce, M.D., San Francisco
James Kieran, M.D., Oakland
Robert Stone, M.D., Oakland
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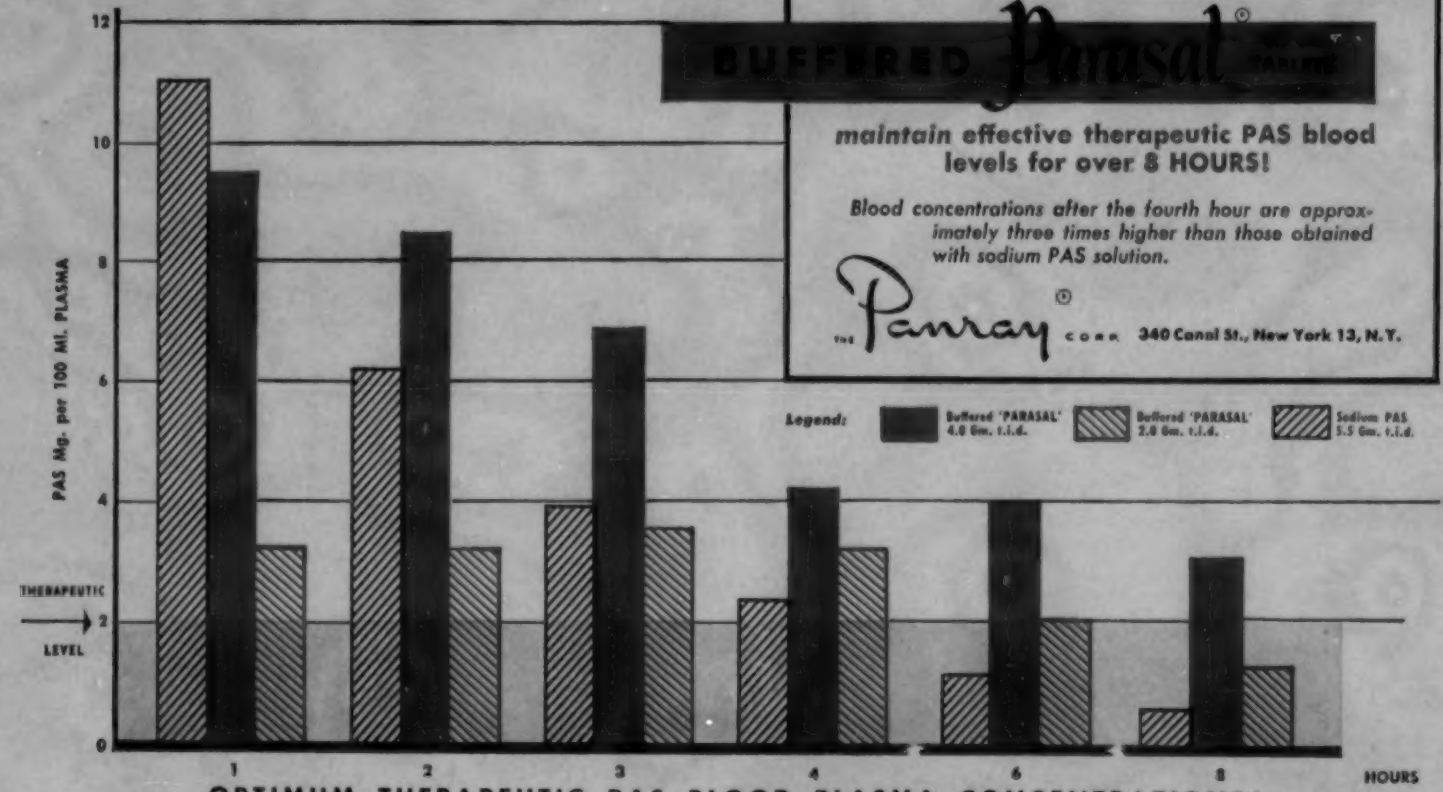

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Ref.: Deeb, E. N. & Vitogliano, G.R.: A. Rev. Tuber. & Pul. Dis.: 72,543-7 (Oct. '55

*based on multiple dosages, levels determined after 2nd dose of day.